# Rhodesia Munitions and Resources Committee.

---

## INTERIM REPORT

FOR

Period ended 30th June, 1916.

# INDEX.

# INDEX *(contd.)*

# Rhodesia Munitions & Resources Committee.

## INTERIM REPORT.

The Rhodesia Munitions Committee was formed in Bulawayo in November, 1915, on the invitation of the Government Munitions and Industries Committee of the Union, as one of the branches of that body. The latter Committee originated through a request from the Imperial Minister of Munitions, who had asked for assistance from South Africa in the direct manufacture either of munitions or of products for local requirements, as any work carried out on these lines would, he stated, help to relieve the stress on Home industries.

A Central Committee was at once formed in Johannesburg, with various branches throughout the Union, and, as stated, one was created in Bulawayo, consisting of the following members:—

*Chairman:* J. G. McDonald, Esq.

J. N. Anton, Esq.
W. Bickle, Esq.
A. F. Bruun, Esq.
J. Buchan, Esq.
A. C. A. Cator, Esq.
W. A. Carter, Esq.
W. Cunningham, Esq.
C. E. G. Cumings, Esq.
Clement Dixon, Esq.
H. W. Durrell, Esq.
L. R. Forbes, Esq.
H. C. Fletcher, Esq.
Father Goetz, S.J.
Noel Griffin, Esq.
A. G. Hay, Esq.
W. Holgate, Esq.
W. J. Hosgood, Esq.
J. Hynd, Esq.
F. Issels, Esq.
Geo. Johnson, Esq.
W. W. Jenkins, Esq.
Major Judson.
G. G. Kempster, Esq.
G. H. Laidman, Esq.
H. B. Maufe, Esq.
A. A. Muir, Esq.
C. H. Pead, Esq.
W. M. Phillpotts, Esq.
G. A. Pingstone, Esq.
F. J. Schofield, Esq.
R. H. Urmson, Esq.
E. A. Uttley, Esq.
A. H. Waller, Esq.
L. H. Whitmore, Esq.
E. A. V. Zealley, Esq.

*Hon. Secretary:* P. H. Taylor, Esq.

At a later date a branch of the Rhodesian Committee was formed in Salisbury.

Mr. W. W. Jenkins acted as Hon. Secretary for a period of several months, until pressure of other work compelled him to relinquish the position.

The lines which this Committee have been investigating and working on to date may be classified as under:—

Inventions.

Assistance to military authorities.

Industries and resources of the country (existing or possible).

Regular meetings of the Committee and Sub-Committees have been held fortnightly with occasional special meetings, in addition to which a large number of interviews and conferences have been held.

The volume of the work has continuously increased, particularly in the investigation of the industries and resources of the country.

The Rhodesian Government has from the first recognised the very useful work that was being carried on and recently agreed that a stage had been reached which justified official recognition. This has been approved by the Administrator and a Government Representative is being appointed to the Committee. From the 1st of July, 1916, the Committee will alter its present name to the "Rhodesia Munitions and Resources Committee."

## INVENTIONS.

Immediately upon the formation of the Committee advertisements were inserted in the local newspapers and the various mines and public bodies throughout the country circularised to the effect that it was prepared to examine and report on any scheme or invention which might be considered likely to be of use to the Imperial Government or its Allies.

In response to this invitation particulars and plans of numerous inventions continue to be sent to the Committee. A large proportion of those examined have been found to be similar to many already taken up. It may be said, however, that great ingenuity has been shown in many instances, and it is remarkable that in several cases schemes submitted from widely separated districts shewed that the inventors had been working on similar lines. The Zeppelin attacks in England would appear to have influenced public thought to a large extent, as instanced by the numerous ideas put forward for their destruction.

The most promising of these were designs for incendiary projectiles, three of which were thonght sufficiently important to submit to headquarters in London. The reply received shewed that all three were considered as worthy of some attention. It appeared, however, after examination, that only one was fit for use, but as it was practically the same as another that had very recently been adopted by the military authorities, it was unnecessary to go further with it.

A portable maxim gun shield has been devised locally and is now under the consideration of the military authorities at Cape Town and on the Northern Rhodesian Border.

A new signalling lamp has been made locally, and experiments made with it show promise. Two are now under construction for further testing.

Apart from the possible utility of some of the devices, it is believed that the work of investigation has been of considerable assistance to the Imperial authorities, on account of the saving of time and work to their officials, who have been relieved from having to make personal examination into many of the designs submitted to the Committee.

## ASSISTANCE TO MILITARY AUTHORITIES.

The local military authorities recognised that the Committee could be of considerable assistance to them over the purchase of special stores, and have utilised its services when necessary.

It was believed that second-hand wire rope could be used in military work, and the Committee circularised all mines on the subject. Prompt replies were received, and in all cases quantities of this material were offered free of cost. The following material has so far been supplied through the Committee to the military authorities on the Northern Rhodesian Border and in East Africa:—

| | *Approximate value.* |
|---|---|
| About 15 miles of wire rope ... ... ... ... | £5,000 0 0 |
| Field telephones ... ... ... ... ... ... ... ... | 250 0 0 |
| Maxim gun shields ... ... ... ... ... ... ... | 150 0 0 |
| Sand bags ... ... ... ... ... ... ... ... ... ... | 100 0 0 |
| Sundry supplies ... ... ... ... ... ... ... ... | 1,000 0 0 |
| | £6,500 0 0 |

The Railway Company gave special facilities for the rapid transit of this material. It may be mentioned that considerable assistance has from time to time been rendered to the military authorities by the Railway workshops at Umtali. In addition to the maxim gun shields manufactured there, they have made practically all the maxim gun tripods required by the Northern Forces. They have also replaced all the springs of the motor transport lorries in use on the Northern road, and have in hand the conversion of the old style bayonet to the pattern now adopted by the authorities.

A complete list of all workshop tools and appliances in Rhodesia was compiled to ascertain what facilities were available for the possible manufacture of munitions in the territory. It was found, however, that the most useful assistance which could be given to the authorities would be through the utilisation, to their utmost extent, of such tools and appliances as were available for the repairs of machinery, etc., generally, and in the making of spare parts of mining, railway, and other requirements throughout the country. This it was seen would help to relieve the stress on Home industries, and would consequently be of considerable assistance to the Imperial authorities.

It has been found that work in this direction has largely increased and continues to grow, and many machinery parts which were previously imported are now made locally.

Suggestions were sent to the Committee *re* the manufacture of munitions by the use of existing workshops and with voluntary labour, during such time as the various workshops were not employed on other requirements.

Very large numbers of our mechanics were ready to help in this connection, but a difficulty presented itself in the supply of raw material and also of special tools.

The Imperial authorities are fully aware of the country's readiness to help, but state that the most useful assistance it could give would be in manufacturing, as far as possible, new and spare parts of machinery and other articles which are imported from overseas. This, as already stated, would help to relieve the stress on Home workshops, and release men and shipping and so contribute indirectly towards the provision of munitions and equipment necessary for the successful termination of the war.

## INDUSTRIES AND RESOURCES OF THE COUNTRY.

It was very soon seen that this section of the Committee's work was by far the most important. Interviews were held with the Visiting Directors of the B.S.A. Company, the Administrator, Brigadier-Generals Edwards and Northey, and others, all of whom considered that the exploitation of the country's resources would be of the greatest importance to itself as well as to the Empire, and that anything which could be done to relieve pressure on workshops at Home would be of the utmost value.

The lines which are at present being followed in regard to this work are:—

Investigation as to what is being done locally in the manufacturing of goods and materials which were previously imported.

Ascertaining the possibilities of substitutes for imported articles.

Investigating and tabulating the resources of the country with a view to the extension of existing industries and the creation of new ones.

## INCREASING OUR EXPORTS.

In connection with the above the Committee may find it necessary at times to mention the names of certain firms, but desire to make it clear that this is with no intention of advertising these.

The objective aimed at is the collection of all possible information in regard to the economics of our natural resources, present and potential local industries, exports, etc., and to publish such for the benefit of the community generally.

The Union Government Committee is working on these lines also, and it is believed that by close co-operation and interchange of ideas mutual benefit to both countries will accrue, and the Rhodesian Government is using its influence with the Union Government to further this.

It is hardly necessary to state that the chief export from Southern Rhodesia, since the opening up of the country, has been gold. History shows that this is not, however, to be relied on as a permanent industry, and no country can remain financially stable if it depends too long on gold production alone for success. It is an excellent asset to possess and it assists materially in starting up any country, but before and during the process of gold exhaustion it is necessary to establish other sound and permanent industries to prevent a state of bankruptcy arising.

An absolute essential for the financial success of a country is the firm establishment of a profitable export trade, and in Rhodesia such a trade should be based on raw materials produced in the country and the manufacture of goods from such products.

To ensure success and stability for exports they must be landed at the point of consumption at such a price as will not only enable them to compete with similar goods from elsewhere, but they must also return a fair and equitable profit to the producer. This can only be done, in a country like Rhodesia, situated so far from coastal ports, and having long distances by rail to cover so as to reach other consuming centres in the continent, through most favourable Railway rates.

With the comparatively small population of the country any manufacturing industry that is started can very quickly reach a stage when it can supply all local demands and further markets have to be looked for—perhaps overseas.

A policy which imposes carrying rates based on the maximum amount it is thought goods can stand would be fatal to the development of any industry, and this view the Committee urges the Railway management to study closely. Other growing countries have fully recognised this fact and fostered new industries by granting specially low carrying rates, particularly during their earlier stages. A broad and far-seeing outlook is essential in dealing with this vital question in Rhodesia. The prosperity of the country as well as that of the Railways is absolutely dependent on such a policy and a system which asks for an immediate profit for the Railways at the expense of the country is absolutely unsound and can only end in disaster to both.

The greatest need of Rhodesia is population. The country cannot possibly prosper without it, but it can only be brought to us through reasonable attractions, such as are offered by other countries. The chief of these would be cheap living, and to ensure this we must have lower carrying rates on our railways than exist to-day.

It has been thought desirable that some particulars of the chief objects which have come under the scope of the Committee's investigations should be given, and on most of these short articles have been written or compiled by members of the Committee. These articles will, it is hoped, be found of interest to all those who believe in the great resources Rhodesia possesses.

It seems clear that if the Empire is to hold its own after the war, and not lose trade, particularly through German efforts, as it was doing prior to 1915, we must organise all our available resources, and urge upon our respective Governments the imperative necessity of assisting in the promotion of such industries as we may reasonably hope are likely to be successful.

Our educational methods should be looked into and much more heed given to scientific research and technical and commercial training than has been attempted so far, and generally we should see to it that our flag which has been so gallantly maintained by our Army and Navy is no longer lowered in trade by unscrupulous rivals.

There is undoubtedly a very strong and growing feeling throughout the whole of the Empire that it is necessary for all of us to bestir ourselves and to take stock of our resources, and it is time that we in Rhodesia were showing with the rest of South Africa that there is ample opportunity for the profitable employment of capital in this part of the world. We have been too long content with our mineral wealth, but that alone is insufficient to enable us to bring in the population we require for the success we are entitled to look for.

The efforts of the Committee have mainly therefore been directed towards showing the possibilities that lie in the development of other industries, and the members will feel encouraged to continue their work if it is seen they have aroused some interest in the subject.

---

## Cattle Industry.

The progress made during the past few years by this industry, which is likely to become at no distant date perhaps the most important in Rhodesia, has been remarkable. Stock-breeders are showing their faith in the country by purchasing in ever-increasing numbers valuable stud animals from Great Britain. A noticeable improvement in the quality of the herds throughout the country is the result. Due to the efforts of the Administrator, the Johannesburg stock-yards were opened for the acceptance for sale of cattle from certain districts in Rhodesia early in the year. An unlimited market would appear to be available for us there for "prime" stock so long as we keep free of disease, and it would seem that

high prices are likely to be obtained for fat stock during the months of September, October and November, though all through the year the demand is good and well worthy of our fullest attention. It is very possible that the extra railage may preclude the eastern part of the country from participating in this new outlet, but breeders there are not idle and are giving much consideration to a meat canning establishment. All the above points to the steady progress of the industry, but "Grade up, grade up!" should be the motto of every stock-owner. With good stock only will he be able to hold the markets and see the value of his land increasing, as it is bound to do if he can show that it will produce animals that he can sell readily and profitably.

The war has undoubtedly caused an increased demand for beef in Europe, but before its outbreak it was apparent that the supply was barely equal to the requirements. The United States have practically ceased exporting and are, in fact, believed to be importing considerable quantities annually; so the existing shortage in Europe is likely to become greater and still more marked after the end of the war.

Our Government fortunately appears to be fully alive to the position and to the great and growing importance of this industry to Rhodesia, and the ready way in which the Agricultural Department at all times gives most valuable advice and assistance to stock-owners is a sufficient earnest of this.

---

## The Manufacture of White Arsenic as a By-product in Gold Extraction.

White arsenic (arsenious oxide) is obtained by roasting arsenical ores. The fumes produced are led through masonry chambers in which the product is deposited as a powder. This crude white arsenic is collected and resublimed in a refining furnace in order to obtain the glassy form of the substance free from impurities.

The process is a simple one which involves very little technical skill.

The chief uses to which compounds of arsenic are applied in South Africa are as cattle and sheep dips, insecticides (as sprays, etc.), for preserving "green" hides and in tanning (as a depilatory). Sheep dips are said to be chiefly mixtures of white arsenic and sulphur, whilst cattle dips are mostly arsenite of soda. The use of arsenite in place of proprietary dips finds increasing favour among stock-breeders.

Sodium arsenite is made by boiling white arsenic with excess of caustic soda solution. As a substance of common use it is comparatively new. The details of its manufacture are not available.

At the present time white arsenic is quoted in London at £30 to £40 a ton. The pre-war price averaged £16 a ton.

The amount of white arsenic or of sodium arsenite imported into South Africa is not detailed in the Customs returns. But the value of sheep and cattle dips imported from overseas in 1914 was £44,231. In 1915, £67,781 worth of sheep dips and £6,324 worth of cattle dips came into the Union. The imports into Rhodesia of cattle and sheep dips were valued at £3,247 in 1914 and £4,036 in 1915. These figures are "declared values": that is overseas, and not local values.

They include certain other dips such as carbolic, which are probably of small quantity. On the other hand, arsenic compounds used in tanning, preserving, and so forth, are not included in these figures.

In Rhodesia many of our gold ores are arsenical, and in treating them we allow the arsenic to go to waste; either it remains in the tailings after cyanidation, or, where the ore is roasted before cyanidation, it largely escapes into the air, where it is irretrievably lost.

At one mine in particular, where the ore contains mispickel (sulpharsenide of iron), a quantity exceeding three tons of white arsenic is daily passed up the stack. This means, at a low estimate, an annual loss of perhaps £20,000 worth of white arsenic calculated at the pre-war price.

Another mine roasts the arsenical concentrate of a similar ore, but does not recover the arsenic.

Mispickel is present in high percentages in a number of other mines in the Gatooma, Umtali, Gwanda, Enterprise and other districts, and in some instances the mineral is so abundant that it might be collected and roasted easily on the spot.

The first mines in the country which might be considered in this respect are those in which their ores are already put through the first and most costly process in the manufacture of white arsenic, namely, grinding and roasting. Without interfering with the treatment and gold extraction, a large proportion of the arsenic which is passed through the furnace might be inexpensively collected by tapping the fumes (or a portion of them) and drawing them by induced draught through a simply-constructed brick chamber fitted with baffles and placed between the furnaces and the stack.

The product so obtained would consist of a mixture of white arsenic, sulphur, ore dust, and presumably compounds of antimony, etc. The amount of antimony contained in this sublimate would be only a small percentage of that contained in the ore since the greater part of it remains in the residue in combination with other metals as sulphantimonates.

The crude sublimate would then be resublimed and the resultant glassy arsenious oxide ground and barrelled or drummed. Probably a brick reverberatory furnace fired with coke would be used for resubliming; but there are cheaper methods in practice on a small scale for refining white arsenic.

The arsenious oxide is caught in a flue of the same type as that used for collecting the crude product.

Obviously it would be advantageous to carry out the refining on the spot, but in certain circumstances it might be accomplished elsewhere.

By collecting the fumes now produced the inconvenience of periodic choking of the stacks would be obviated.

One mine in particular has certain advantages over others for the collection of white arsenic which it produces, as it roasts the concentrate of its ore only, whereas most other mines roast the whole of their ore. Consequently the fumes of the former contain less ore-dust and therefore a higher percentage of arsenious oxide. Further, the ore referred to carries only a minute quantity of antimonite, which is a decided advantage.

There is a very considerable shortage of cattle and sheep dips at the present time owing to shipping and labour difficulties. This shortage is likely to become more serious still. Large quantities of dips are used in South Africa and the demand is on the increase. Moreover, a local supply of arsenic would lower the price of dips and stimulate demand. An abundant cheap supply of dips would render it easy to enforce compulsory dipping of native herds. This would eventually rid the Territory of cattle diseases due to ticks, and the export cattle trade would be established and safeguarded. It is therefore a matter of some urgency and seems to be well worth while for certain of our mines containing that mineral to recover and purify their arsenic, and for a small factory to be established here or at the coast (where similar work is already carried out) for the preparation of sodium arsenite and the dips, insecticides and other preparations of arsenic for which there is considerable demand in South Africa.

The excess of white arsenic above local requirements if exported to England should afford a fair profit given reasonable transport charges. The manufacturers of cattle and sheep dips are very large users of white arsenic and sodium arsenite.

In reply to enquiries recently made by the Committee, the Secretary for Mines and Industries of the Union of South Africa states that: "As regards white arsenic, there should be an excellent market in the Union if supplies of fair qualities can be put down at anything like a reasonable price. . . . The present, moreover, offers an exceptional opportunity for exploiting any such deposits that you may possess.

"I shall be glad to hear further from you regarding this arsenic, and, if sufficient development or experiment has taken place to justify you sending me an estimate as to the cost at which the material could be sold in the Union, I might possibly be in a position to supply you with more definite information as to the prospects of trade here."

## Lime for Agricultural Purposes.

All farmers know the great value of lime as a fertilizer, yet this most valuable producer of plant food is not used nearly so much as it should be.

It is unfortunate that the bulk of the soil in Rhodesia is deficient in this mineral, and consequently it ought, in some form or other, to be applied to it and renewed periodically if farmers wish to be just to their cultivated land. The chief value of lime lies in its power of releasing plant food which otherwise is not available. It lightens heavy and sweetens sour soils. It attracts moisture. It neutralises the acidity of vlei land and encourages the presence of bacteria that are most valuable in drawing supplies of nitrogen from the atmosphere through certain plants, which benefit greatly in the process. These bacteria are of inestimable benefit to farmers, for the healthy growth of many crops depends entirely on their efforts. They will not, however, thrive or work if there is no lime in the soil; in fact, where it is not present they scarcely exist. For leguminous plants, and lucerne especially, lime is an absolute necessity. It is also required by root crops, cereals, fruit trees, etc. In fact, if nature has failed to provide it in certain areas it must be put there if fair crops are to be looked for.

Its aid in improving the growth of bone in stock is so well-known as to hardly need mention, but it may be stated that its total absence from food is likely to check the development of the frame of any animal; hence all stock-owners should see that if not present in the soil of their farms it should be put there.

Speaking generally, nature has provided Rhodesia with vast quantities of this most valuable mineral and it is to be found in most districts of the country, but unfortunately not in all, and where it is non-existent it is most wanted, as the veld in such is distinctly "sour."

There is no reason, however, why it should not be readily obtainable, for it could be laid down at every station on the Rhodesia Railways at a very reasonable cost. In the Union it is in many cases delivered free on rail at 20/- a ton, and even less, and the railway rates for its carriage, when it is used for agricultural purposes, are exceedingly low, and no doubt our General Manager of Railways has only to have the case sufficiently well put before him for farmers to get similar rates in this country.

---

## Notes on Lime.

"Cements" as distinguished from "Limes" are materials which are capable of solidifying when in contact with water without perceptible change of volume or notable evolution of heat.

Hydraulic Limes possess the power of setting or solidifying under water.

All limes have a tendency to expand and to fall asunder when treated with water; the purer the lime the more energetic and rapid is this action, while, conversely, the greater the quantity of clayey matter combined with the lime the less intense, as a rule, is the chemical affinity for water, and the slower is the act of hydration, and to this extent the greater is the resemblance of such limes to cements.

It may be assumed that limes of many different degrees of energy, from pure carbonate of calcium down to true calcareous cements, exist in nature; thus there is an enormous range of varieties of action to be studied, and any attempt to classify all limes under two or three sub-heads must be untrustworthy.

For economical purposes limes carrying less than 5% of impurities can be classed as a pure or rich lime.

Limes containing over 5% of impurities differ so markedly in their properties that each variety would have to be separately classified. They will therefore be designated under the heading of poor limes.

With regard to the methods of burning, the types of kilns employed in lime-burning may be grouped as follows:—

1. Intermittent kilns.
2. Continuous kilns with mixed feed.
3. Continuous kilns with separate feed.
4. Ring kilns.
5. Gas fired continuous kilns.

Taking a pure limestone, theoretically for every 100 tons of stone there should be 56 tons of Caustic Lime produced. In practice, however, it takes roughly two tons of pure limestone to produce one ton of lime; this applies only to the pure limestones. With the impure limestones the greater the quantity of clayey impurities the greater the percentage of burnt lime per ton of limestone, but as the clayey matter is present in the product the value is reduced proportionately.

(1) Intermittent Kilns are those in which each burning of a charge constitutes a separate operation. The Kiln is charged, burned, cooled, the charge drawn, and the kiln again charged. In this type of kiln the loss of heat is enormous, as the sides of the kiln have to be raised to the necessary degree of heat every time the kiln is charged.

(2) Continuous Kilns with mixed feed.—In kilns of this type the limestone and fuel are charged into the kiln in alternate layers. As the burning progresses the burned lime is drawn from the bottom of the kiln and fresh layers of limestone are added at the top. The fuel consumption is much less in this type of kiln than in the intermittent type. In both the continuous and intermittent the burnt lime is discoloured by its contact with the fuel, and the ashes of the fuel cannot readily be separated from the burnt lime, thereby lowering the quality of the product. a part of the fuel, ashes, clinker on the outside of the lumps of lime, preventing even and satisfactory burning. There are various types of continuous kilns in operation, from the crude to the scientific ones.

(3) In Continuous Kilns with separate feed the fuel used is either coal or wood, and, as the fireplaces are placed outside the kiln proper, the limestone does not come in direct contact with the fuel, but only with the hot fuel gases. This type of kiln takes more fuel than the continuous mixed feed type; the product, however, is of a much higher grade, and another advantage is that the firing can be kept under better control. so that the percentage of overburnt and underburnt is far less than in the continuous and intermittent types.

(4) Ring Kilns—on the Hoffmann plan.—This kiln is very expensive to build, requires skilled labour to run it, is economical in fuel, but the ashes of the fuel are mixed with the lime.

(5) Kilns fired with Producer Gas.—These kilns are rather expensive to build. The burning is under perfect control and the various stages in the burning can be inspected by means of small doors. No ashes mix with the lime, the fuel consumption is small, and inferior fuel that could not be burnt in any other type of kiln can be used. The kiln can be stopped in a few minutes and left for a day or so, then re-started in an hour, which is impossible with any other type of kiln. The gas used is crude producer gas, which flows by natural draught direct from the producer to the kiln; there is little danger of explosions and no scrubbers or fans are used. Unskilled but intelligent labour can be used with this type of kiln.

---

In burning any limes, whether rich or poor, in all kilns in which the fuel mixes with the lime, there is always a certain proportion of the lime spoilt through the clayey matter entering into combination with the lime.

A great number of the poor limes require very careful burning, as a little too much heat clinkers the product, and not quite enough means underburning it; consequently, with a kiln with the burning not under control. the quantity of waste may be very great.

For farming or cyaniding the richest possible lime should be used, as the impurities contained in a poor lime being present in the burnt product represent so much more useless material to pay carriage on, and, in the case of very hydraulic limes, there is a tendency to set when mixed with water or from the dampness of the ground.

For building purposes poor limes are preferable to rich ones.

Burnt lime when put into bags requires to be thoroughly protected from any water, as the caustic lime during the process of slaking generates sufficient heat to fire the bags.

The most economical method for conveyance of lime is loading unslaked lime in bulk in truck loads, the truck carrying the lime to be well protected from moisture. By this method the consumer saves the cost of bags and transport on the water absorbed by the lime in the process of slaking.

## Dipping Tanks.

There seems to be little doubt that the construction of dipping tanks in the territory will keep on increasing until all cattle districts are fully equipped.

The majority of existing tanks are constructed of concrete, which makes a very efficient structure, but first cost is high, varying from £120 to £150 or even £175. The chief cause of this heavy cost is that in most cases skilled labour has to be employed for the construction.

It is believed that a very much cheaper structure could be made by the use of $\frac{1}{8}$-inch thick mild steel plates instead of concrete. It is not claimed that there is anything new in this type of dip, but it does not appear to be generally known that a mild steel dipping tank can generally be built cheaper than a concrete one, principally because the former can be erected complete without employing any other labour than that of the farmer himself and his own natives. An additional advantage is that it can be erected much more quickly than a concrete tank.

Replies to inquiries made show that no detrimental effects are likely to be experienced with arsenical solution in contact with the steel plates.

The tank can be constructed in three or more sections, each section marked as to its position and the necessary bolts and jointing material for putting it together are easily obtainable. Plans are being prepared shewing the sections assembled and their markings, and also the size of excavation necessary to receive the tank. The only work required at the site would be: excavations taken out to plan. assembly of tank, putting it in place, and tarring it.

The question of fencing for the receiving yard, etc., is not considered here, as each owner can erect same to suit his individual requirements.

When completed the plans will be handed over to the Veterinary Department for general information. Attached will be an estimate of cost of tank on rail complete with bolts, etc., all ready for erection.

There is at present considerable difficulty in getting steel plates exported from Great Britain, but temporary supplies can doubtless be arranged from America.

---

## Fruit Industry.

From some parts of Rhodesia we may confidently hope for a large production of citrus fruit in time, and where the altitude is 5,000 feet and over apples do exceedingly well, but in regard to deciduous fruit we can never expect to do very much. For the latter the West and South-West districts of the Cape can never be approached by us, as the success of stone fruit mainly depends on winter rains and a dry period while it is ripening. Our rains, falling as they do in summer, are. as far as fruit goes, only really suitable for citrus varieties.

At the same time some considerable success is quite likely to be achieved with the very early kind of apricots, peaches, plums, etc., and there is no reason why Rhodesia should not be able to provide for all its own requirements of dried fruits as well as for much of the jams the country at present purchases from outside if the right trees are planted. In connection with the former, it may be mentioned that at the Rosebank Show held at the beginning of this year it was shown that last year the Cape had produced no less than 500 tons of dried apricots, which those qualified to judge stated were quite as good as anything of the sort produced in California. The demand is still far greater than the supply. One grower remarked at the Show that he had sold £1,500 worth at a very handsome profit. The gritty, sandy and often decayed dried fruit the Cape used to put on the market, and which no one would buy, is a thing of the past. In regard to the production of oranges, many parts of the country are admirably suited for the growing of these, but if success is to be looked for better methods of handling the trees than are in most cases in vogue must be adopted. The suitability of the soil must be determined, and an ample water supply is absolutely essential. Frequent cultivation is necessary; the right trees must be planted, and they must be properly cared for, as they require constant attention. Spraying must be carried out and the picking done at the right time. Proper sorting and packing are necessary, so that a buyer may feel assured that he is being fairly treated and running no risk of finding undersized, damaged, or diseased fruit in his purchase.

People who plant trees and leave them more or less to look after themselves are a danger to every grower, and are the cause of all sorts of diseases and pests spreading throughout the country. If necessary, legislation should be passed to deal with such for the protection of what is likely to be an important industry. An Orchards' Ordinance is in existence in Rhodesia, but it does not seem to be applied. What is required is the systematic inspection of all fruit-growing areas by the Government Entomologist with a view to getting his advice as to keeping the plants free from disease and also on the question of the proper spraying solutions to be used in particular cases. The clearing of the veld of all parasitical plants in fruit-growing areas should also receive consideration.

It may safely be stated that the orange, of all fruits grown in Rhodesia, is going to be the one fruit which is likely to be most profitable, as it is eminently suitable for export in quantity and ripens with us at a season when there is a large demand for it on the London market.

As the services and advice of a highly-qualified Government expert are obtainable, anyone who contemplates starting an orchard should consult this official before incurring any expenditure in connection with such a venture.

It is of the utmost importance to everyone who may plant even a single fruit tree that it should be purchased from a known and reliable nurseryman, and any tree that has been more than six months in a tin should be discarded. If properly packed, trees are likely to do far better if lifted direct from the nursery and sent well wrapped in damp moss to their destination. Further, the pit system of planting trees cannot be condemned too severely unless the whole of the ground to be put into orchard is first ploughed, harrowed (or cultivated), and then re-ploughed and cultivated again. In any pit then dug the ground must be replaced in the same layers in which it was taken out, but there is no longer any necessity for digging pits. The ground after being well ploughed can be admirably "subsoiled" by dynamite, a charge being exploded in a drill hole three to four feet in depth where it is intended to set each tree. This is far better and perhaps cheaper than digging holes for the trees with pick and shovel. Besides, it shatters the surrounding ground, which enables the roots to readily make depth.

In regard to the bottling of fruit, there is no doubt that many small as well as large growers could find a ready sale at a good profit for the bottled article if it is kept consistently and exactly to standard. It is well known that many successful firms at Home and in South Africa started the bottling of fruit, pickles, sauces, etc., on "home-made" lines from home recipes, and often commenced businesses in a very small way, but by keeping their wares up to standard they created a big demand and a resultant large and profitable business. A bottling plant is not costly, and with early ripening fruit good results should be obtained.

It seems to the writer that a decision recently arrived at by the Government of New South Wales might well be adopted in a modified form in Rhodesia. This was to provide for agricultural instruction for boys in some of the country high schools distributed over different parts of that State. Many boys attend these schools for two years only, and the ordinary secondary school course is not the most suitable for them. Moreover, they fail to qualify the boys for gaining a livelihood on the land. The courses of study in these schools are now to be modified. The boys taking the agricultural courses will omit the study of languages other than English, and devote about one-half of their school time to the theory and practice of agriculture. Their classroom work will include a study of elementary science in its relation to agriculture, and this will be supplemented by practical work on the school farm. Arrangements are now being made for the provision of an area of ground convenient to the school in each case, on which experimental and demonstration work of a practical kind will be carried out by the boys under the direction of a specially qualified teacher. The Minister of Education is confident that by increasing these opportunities the number of boys looking to the main primary industries of the State for a career will be increased and will bring to their work an appreciation of the scientific principles underlying it. It is satisfactory to know that our Director of Agriculture is fully alive to this highly important matter and is giving it his attention.

---

## Explosives for Subsoiling.

The principles of Modern Scientific Farming are becoming more and more widely known, and, to the progressive farmer, more fully appreciated as time goes on.

It is only within recent years that High Explosives came to be recognised by the farmers and fruit-growers of the Cape Colony as almost a necessity to the better cultivation and productivity of the soil.

In America, however, "Subsoiling"—as it has now come to be termed—by dynamite has for many years been an essential factor in the prosperity of its extensive fruit industry.

Instances of marvellous growth and healthy resistance through seasons of drought and trying conditions are to be seen in our own territory to-day, where subsoil dynamite has been employed.

In this paper space will only permit of the subject being briefly dealt with under three headings. Firstly, the object to be attained; secondly, the purpose to which subsoil dynamite can most advantageously be applied; and, thirdly, the cost.

Practically all our soils consist of a surface layer of varying depth fairly easy to the usual mode of cultivation, underlaid by a hard subsoil more or less impervious to moisture and mostly impenetrable to the roots of trees or plants.

The result of such conditions is often evident in diminished growth and stunted appearance, particularly after the first or second year's growth of the plant, and in the existence of "brak" veld and marshes common to many parts of this country.

The object which it is desired to attain through the medium of explosives manufactured specially for the purpose is to shatter this dense subsoil and to produce fissures through which air and moisture may pass, allowing the roots freedom of growth and access to plant food in the subsoil which otherwise they would never be likely to reach.

In regard to marshy sour veld the result of this subsoiling is obvious. The shock of the explosion breaks through the impervious substrata, causing fissures, through which surface water is allowed to escape; in other words, creating an efficient and cheap medium of drainage.

The purposes to which subsoil dynamite can advantageously be applied, in addition to the foregoing, are:—

The preparation of the ground for the planting of trees and shrubs.
The cultivation of lucerne, cereals, tobacco, cotton, etc.
The blasting and removal of stumps and ant-heaps.

Existing plantations, orchards, lucerne, and other crops may also be "toned up" without injury to the plants or loss of crop to the farmer.

Generally speaking, the best time to subsoil ground is a month or two before the rainy season. The soil will then be ready to store up large quantities of moisture which in the ordinary course would flow over the surface, or at the most penetrate only a few inches.

Cost is, of course, an important factor in the consideration of any new agency affecting the old order. For the purposes advocated dynamite is cheaper than labour, both in cost and time saved; it is also cheaper in the return given for the capital invested, particularly so when it must be understood that, whatever the initial cost, the outlay is not an annual one, since in the effectiveness of the operation the expenditure can be apportioned over a certain number of years—say, three to five, as conditions require.

As indicating cost per acre the following table may be of interest, the material being based on current prices, which in respect of detonators and fuse are slightly higher than in normal times but do not affect the approximate total cost very much.

| Spacing of Holes | No. of Holes per acre | Lbs. of Explosives per acre | Detonators per acre | Fuse (feet) per acre | Cost per hole hole including labour | Total cost per acre |
|---|---|---|---|---|---|---|
| 10' x 10' | 436 | 109 | 436 | 1308 | 4½d. | £8 2 5 |
| 12' x 12' | 303 | 76 | 303 | 909 | 4½d. | 5 13 2 |
| 15' x 15' | 194 | 49 | 194 | 582 | 4½d. | 3 12 6 |
| 18' x 18' | 135 | 34 | 135 | 405 | 4½d. | 2 10 7 |
| 20' x 20' | 109 | 27 | 109 | 327 | 4½d. | 2 0 4 |
| 25' x 25' | 70 | 17 | 70 | 210 | 4½d. | 1 6 0 |

NOTE.—The quantity of fuse as shown on this table is based on the assumption of the holes being three feet deep.

NOTE.—The cost per hole is estimated on: Subsoil dynamite at 35/6 per 50lbs. Fuse, present war prices, 8d. per coil of 24' Detonators, present war prices, 7/- per 100. Native labour, 1/- per day each for two double hand hammers, drilling, say, 60 holes per shift.

## Beet Sugar.

The Agricultural Department, Salisbury, does not recommend the growing of this crop, either as a source of sugar or for feeding purposs, as experiments which it carried out gave in every case very disappointing results in the weight obtained per acre.

It may be stated, however, that some time before the war broke out the Makwiro Farmers' Association went very fully into the prospects of this crop, and concluded there was a fair possibility of success in it. Their intention was to grow sugar beet in the Makwiro district, and establish a sugar factory in a central position there.

The matter had advanced considerably and certain agreements had been entered into between a large number of the farmers in the district, when the outbreak of war stopped further negotiations.

The Committee is informed that it is the intention to raise the subject again on the first suitable opportunity.

Doubtless the Association, before committing themselves finally, will ask for the co-operation of the Agricultural Department in proving definitely if the Makwiro district is more suitable for the cultivation of this crop than other districts in Rhodesia.

It may be mentioned for the information of those interested that the value of imports of sugar to Southern Rhodesia for the last five years has been as follows:—

| 1911. | 1912. | 1913. | 1914. | 1915.. |
|---|---|---|---|---|
| £39,102 ... | £47,306 ... | £46,619 ... | £49,701 ... | £60,118 |

The above includes sugar products, *e.g.*, Golden Syrup, Molasses, Treacle.

---

## Fibres.

The following memorandum, sent to the Committee by the Imperial Institute early in May in reply to a communication from it as to the value of fibres, is of considerable interest in connection with this subject:—

> A number of fibrous products from Rhodesia have been examined at the Imperial Institute, and reports on these have been published in "Selected Reports from the Scientific and Technical Department: I., Fibres," and in the "Bulletin of the Imperial Institute," Vol. XLII. (1915), pp. 21-23.
>
> The fibres most worthy of consideration with a view to the establishment of an industry in Rhodesia are (1) Sisal hemp, (2) Mauritius hemp, and (3) *Hibiscus cannabinus* fibre.
>
> (1) A fibre plant which would naturally be expected to grow well in Rhodesia is *Agave sisalana*, the Sisal hemp plant, which is being cultivated with great success in East Africa. An account of the methods of cultivation and preparation of this fibre, including information with regard to soil, age at which cutting may be commenced, and the duration of the life of the plant, is given in the "Bulletin of the Imperial Institute," Vol. XIII. (1915), No. 3, pp. 430-446. For the cultivation and extraction of Sisal hemp on a remunerative scale a large amount of capital is required, so at least 500 acres must be planted to justify the erection of a factory and the installation of the necessary machinery. The crop is therefore unsuitable for individual planters unless possessed of ample means, but it can be grown with considerable profit by a number of planters working in co-operation.
>
> It is stated in the "Rhodesia Agricultural Journal," Vol. X., (1912-13), p. 267, that experiments with Sisal hemp both by the Agricultural Department and by private farmers have not been very encouraging. It might be worth while, however, to carry out further trials before concluding that the plant is not adapted to the country.
>
> The present price of Sisal hemp in London is £51-52 per ton, but this is double the average price in normal times.

The Mauritius hemp plant (*Furcraea gigantea*) is of similar character to *Agave sisalana*. It is stated in the "Rhodesia Agricultural Journal" (*loc. cit.*) that experiments in Rhodesia have shown that this plant is better suited to local conditions than Sisal hemp. The leaves of *F. gigantea*, however, yield a smaller percentage of fibre, and the value of the latter is, in general, a little below that of Sisal hemp. The fibre is at present quoted in London at £44-46 per ton. An account of Mauritius hemp and its cultivation has been published in the "Bulletin of the Imperial Institute," Vol. VIII. (1910), No. 3, pp. 265-273.

(3) With reference to the fibre of *Hibiscus cannabinus* of Rhodesia, samples which have been examined at the Imperial Institute have shown that the methods of extraction practised in Rhodesia are not satisfactory. The fibre should be prepared by the method employed in India, which is identical with that used in the preparation of jute. An account of the process of jute extraction in India is given in the "Bulletin of the Imperial Institute," Vol. III. (1905), No. 3, pp. 253-255. An ample supply of water is necessary for retting the fibre and a good deal of manual labour is involved. The Indian fibre *H. cannabinus*, known in the market as "Bimlipatam jute" usually realises prices somewhat lower than those of true jute. The price of jute is subject to wide fluctuations and is at present exceedingly high, "first marks" being quoted in London at £33 per ton and Bimlipatam jute at £28 per ton, whereas in normal times these grades realise, on the average, about £20 and £17 18s. 0d. per ton respectively.

It is not likely that the fibre could be obtained in regular commercial quantities from the wild plants, and it would therefore be necessary to undertake systematic cultivation. The question as to whether this could be carried out profitably in Rhodesia could only be decided by actual trials.

The "Selected Reports" on Fibres referred to in the first paragraph of this memorandum, was issued as a Parliamentary publication (Colonial Reports: Miscellaneous No. 58), and can be obtained from Messrs. Wyman and Sons, Ltd., Fetter Lane, London, E.C., price 7d., post free 9d.

The single numbers of the "Bulletin of the Imperial Institute" referred to can be obtained as follows:—Vol. III., No. 3, and Vol. VIII., No. 3, from Messrs. Eyre and Spottiswoods, East Harding Street, London, E.C., price 1s. each, post free 1s. 2d. each. Vol. XIII., Nos. 1 and 3, from Mr. John Murray, Albemarle Street, London, W., price 2s. 6d. each, post free 2s 9d.

There is at present no general text-book on Fibres which would be of any use to you in connection with your enquiry. A book on "Vegetable Fibres," by Dr. E. Golding, of the Imperial Institute staff, will, it is hoped, be published during the present year in the series of "Imperial Institute Handbooks to the Commercial Resources of the Tropics," and this book will contain full information regarding the fibres mentioned in the memorandum.

In forwarding the above memorandum, the Imperial Institute state that anyone wishing to carry out experiments with these fibres should obtain the co-operation of the Department of Agriculture at Salisbury.

It will be noted that Agave sisalana is cultivated with great success in East Africa, and the following information on the subject shews the great advance made since it was first introduced:—

Agave sisalana, perhaps the hardiest of hemp-producing plant, is indigenous to Mexico and was introduced to Africa in 1893. It was first taken up by the Germans in East Africa and three bales were exported in 1898, followed by seven tons in 1900. After that its progress was uninterrupted and in 1912 it was exported to the value of £370,000 and in 1913 to over half a million pounds sterling.

It has been entirely adopted for use in the German Navy and has altogether ousted Manilla hemp there.

The manufacturing of rope, twine and packing is carried on in a small scale in the Union. The material turned out is of first-class quality, but on account of the small factory capacity only a small proportion of the local demand can be met.

The rope is manufactured with imported fibre, as the manufacturers wished to establish the industry with an article of first-class uniform grade, and under existing conditions, with the factory working to its utmost capacity, there is no chance of experimenting with local fibre for the time being. The extension of the works is, however, now under consideration, and when this is carried out the Company will be in a position to experiment with the local product.

---

## Oil and Soap Factory.

A small plant for expressing oil from ground nuts and oil-bearing seeds, etc., was erected in Salisbury and commenced operations in May, 1915.

The capacity of this plant is only equal to the treatment of about 7,000 bags of ground nuts per annum.

The internal demand for vegetable oil is small, and with existing conditions there is no immediate prospect of export trade.

It may be mentioned that samples of ground-nut oil from both Northern and Southern Rhodesia submitted to the Imperial Institute were reported to be of very good quality and "superior to the highest grade oil met with in this country." The samples were pronounced by commercial experts to be worth up to £45 per ton in London.

Under these conditions the oil factory could not have continued operations, and the manufacture of soap from vegetable oil was therefore started recently.

The quality of the soap being manufactured is very good, but the maximum possible output is not nearly sufficient to meet present orders, apart altogther from consuming capacity of the country.

In addition to the ground nut there are many other oil-bearing seeds available, but with the existing plant capacity it is very evident that only a small fraction of even the ground nuts can be dealt with, excluding all other seeds which might profitably be grown.

Oil cake made from the residue of the nuts treated finds a very ready sale among the farming community on account of its high food value. It is superior to linseed cake as shewn by the following analysis:—

| | |
|---|---|
| Nitrogenous matter or proteins in ground nut cake ... | 30.71% |
| Oil contents of ground nut cake ... ... ... ... | 14.4 % |
| Nitrogenous matter or proteins in linseed cake ... ... | 28.56% |
| Oil contents of linseed cake ... ... ... ... ... ... | 9.97% |

The method of soap-making adopted is very simple and easily worked, and the capital outlay for the plant was small. All the oil is saponified, no separation being made of the valuable product glycerine which is in urgent demand for the manufacture of explosives.

When the enlargement of the plant, which is very urgently necessary, is taken in hand full consideration should be given to the separation of this valuable article.

The approximate amount of oil expressed per bag of ground nuts is 17 lbs., and the glycerine contents of this oil is nearly 10 %. It will be seen, therefore, that the quantity of oil which can be produced by the existing plant is only about 60 tons per annum. From this oil, by present methods of manufacture, about 100 tons of soap per annum can be turned out.

Following is the value of imports of soap into Southern Rhodesia during the last five years:—

| 1911. | 1912. | 1913. | 1914. | 1915. |
|---|---|---|---|---|
| £19,251 ... | £22,435 ... | £24,662 ... | £24,550 ... | £25,358 |

The above figures shew a quickly growing market for the commodity, and it is evident that with our large native population this will continue to increase.

The soap made by the local factory is in very great demand, but the maximum output cannot possibly cope with the orders now being placed.

The imports for 1915 represent a weight of nearly 830 tons of soap, whereas, as already stated, the maximum output of the existing factory is 100 tons per annum.

As ground nuts for far more than all possible Rhodesian requirements of oil and soap for many years to come can easily and profitably be grown in the territory, it is very evident that immediate steps should be taken to greatly enlarge the factory and put this sound industry on a satisfactory basis. If the factory is at once enlarged there should be no difficulty in getting our farming community to supply the raw material.

It may be mentioned that the demand for ground nuts in Europe is very large and a co-operative arrangement might be made whereby the oil and soap factory would purchase all ground nuts sent in and ship the surplus to Europe. In this connection the following extract from an Overseas Chamber of Commerce Journal is of considerable importance:—

"To many British merchants and manufacturers ground nuts and ground nut oil are little-known products. The unshelled nuts, known also as monkey nuts, pea-nuts, or earth nuts, are sold by retail fruiterers in this country, and the shelled kernels, roasted, are used as a cheap substitute for almonds by manufacturing confectioners. It is fairly safe to predict that the ground nut is destined to become of far greater importance than it is at present as a source of table food products for general consumption in the United Kingdom.

"Large quantities of ground nuts are produced within the British Empire, and the exports from India and British West Africa in 1913 amounted in value to nearly four millions sterling, and about three-fourths of the quantity are shipped to France. The chief importing countries for ground nuts before the War were France, Germany and Holland, and the most important crushing centres were Marseilles, Bordeaux, Dunkirk, Hamburg and Delft. Most of the ground nuts imported into France are used for the production of oil and feeding cake of good quality. The oil is used as salad oil for culinary purposes and in the manufacture of margarine. The inferior qualities are used for soap-making. The cake left on extracting the oil from the kernels is one of the best feeding cakes for live stock. The physical and chemical contents of ground nut oil are: specific gravity 0.918 to 0.925, saponification value 185.6 to 197, iodine value 83.3 to 105. Ground nuts are grown in very large quantities in the United States, where they are sold in the streets as roasted pea nuts. Large quantities are also consumed in the United States in the form of 'pea nut butter,' a product made by grinding the roasted, blanched and salted kernels into a soft paste. In the northern parts of the United States there is hardly a town of 30,000 population or over which has not one or more pea nut factories, so popular has the article become as a regular table food. The preparation is very simple, cleanliness and care in roasting, blanching and picking being the chief factors of success. There are many grades of pea nut butter produced from different kinds of pea nuts. In West Africa and other countries where ground nuts are grown the bleached kernels are often used as a vegetable, especially in the form of ground nut, and their use in this way in Europe might be largely extended. In view of the increasing popularity of prepared foods, it should be possible to use much larger quantities of ground nuts in the United Kingdom, where the present consumption, compared with the half-million tons annually used in France, is insignificant. During the past year increasing quantities have been imported and crushed for oil and cake, but the business is still capable of large expansion."

As large tracts of the soil in this territory are particularly suitable for the growing of these nuts, and as it is a very good drought-resisting plant, as instanced by one farmer during last season getting a return of fully 25 bags per acre with a total rainfall of under 10 inches, it would seem a most suitable crop for our farmers to cultivate.

The oil and soap plant referred to consists of:—

Storage shed for ground nuts and other oil seeds.
Two-storey brick building.
13 horse-power steam engine and loco. boiler.
Ground nut sheller with fan.
Ground nut grinder.
Steam jacketted kettle.
Hydraulic press with pumps.
Filter press with pumps.

The above comprises all the machinery for oil expressing, and is situated on the ground floor.

Soap-making is carried out on the top floor, which was originally intended for storage purposes. The only mechanism here is a small hand fly press for stamping toilet-soap tablets. All other soap-making operations are conducted by the hand labour of natives.

The factory, which was not originally intended or laid out for soap manufacture, could easily and cheaply be extended, and this question should be taken in hand without delay.

---

## Bacon Factory.

A small Bacon Factory was started in Salisbury in October, 1914, and has fully justified its installation.

The output has been progressively steady, and at present an average of about 60 pigs per week is dealt with.

The factory output consists of bacon, hams, sausages and lard. The demand has constantly been greater than the output, and there is rarely any necessity to store products in the cold storage chambers.

There is scope for very considerable expansion in this industry, as shown by the figures given herewith of imports into Southern Rhodesia during the last two years:—

| | 1914. | | 1915. |
|---|---|---|---|
| Bacon ... ... ... ... | £14,420 | ..... | £11,750 |
| Hams ... ... ... ... | 5,169 | ..... | 3,075 |
| Lard ... ... ... ... | 2,585 | ..... | 2,541 |

The capacity of the existing plant is from 80 to 100 pigs per week.

The existing factory is, however, often very severely cramped when a larger number of pigs than usual is received.

The increasing deliveries and the growing demand for the output shews that there is an immediate necessity for at least doubling the capacity of the existing plant. If this work is not promptly put in hand a time will come at an early date when farmers who are breeding pigs, and sending them to the factory, will find that its maximum production has been reached, leaving them with considerable quantities of stock on their hands which they cannot dispose of, though the local demand for factory products has been far from satisfied.

All the products turned out by the factory are of excellent quality and fit to complete in all respects with the imported article.

The factory could probably be doubled for a cost not exceeding £4,000.

---

## Butter and Dairy Products.

A Creamery was opened in Gwelo in May, 1913.

The capacity of this plant is about 600,000 lbs. of butter per annum, while the present turnover is at the rate of 150,000 lbs. The weight of butter and butter substitutes imported in 1914 and 1915 was 190,042 lbs. and 129,078 lbs. respectively. The exports from Southern Rhodesia for the same period were 60,589 lbs. and 52,144 lbs. respectively. It is evident, therefore, that, as regards its output capacity, the Gwelo Creamery can more than cope with the existing butter trade.

There appears to be considerable dissatisfaction, however, amongst a number of dairy farmers, as the distance to the Gwelo centre prevents them sending their supplies to the Creamery.

Proposals have been made for the overcoming of the difficulty, and the scheme suggested would seem to be worthy of full consideration.

This is to have collecting centres, say at Salisbury, Bulawayo, or at other points thought necessary; the cream to be sent to such centres, and on arrival placed in cold storage chambers to prevent deterioration pending forwarding to Gwelo Creamery. The cream would be analysed on arrival at such centres and payment made on butter-fat contents.

As the value of imports of butter and butter substitutes into Southern Rhodesia for the last five years amounted to:—

| 1911. | 1912. | 1913. | 1914. | 1915. |
|---|---|---|---|---|
| £25,264 | £27,909 | £27,491 | £14,710 | £10,717 |

it is obvious that a very considerable sum of money is still sent out of Rhodesia for the purchase of butter and its substitutes, and with proper organisation most of this could be circulated in the country. Once the stage is reached when all the butter requirements of Southern Rhodesia are met by local production, the dairy industry will naturally cease expanding unless other outlets have been found, either through increased export trade or in the manufacture of other dairy products.

Two very promising lines are cheese-making and the manufacture of condensed milk.

The imports of cheese into Southern Rhodesia for the last five years are as follows:—

| 1911. | 1912. | 1913. | 1914. | 1915. |
|---|---|---|---|---|
| £7,051 | £6,922 | £8,233 | £6,050 | £6,445 |

Large quantities of condensed milk are also imported annually, as shewn by the imports for the last five years:—

| 1911. | 1912. | 1913. | 1914. | 1915. |
|---|---|---|---|---|
| £16,737 | £18,567 | £18,205 | £13,652 | £10,873 |

There was a considerable decrease in the imports for 1914 and 1915, but this is probably solely due to the war. It is believed that the trade in condensed milk is a growing one on account of the increasing demand for this product among the native population.

The making of cheese and condensed milk would therefore seem to be worth following up.

---

## Tobacco.

That Southern Rhodesia has in the past produced some very good tobacco there can be no doubt, and satisfactory prices have been paid for such; at the same time there is necessarily a limit to the quantity which can be consumed in Africa, and if this quantity is exceeded the surplus must be exported or the result is disastrous to the tobacco-growers. The fact that Southern Rhodesia has already grown in one year a crop of something like two million lbs., which it had the utmost difficulty in disposing of, proves that there are already sufficient growers in Rhodesia to meet the local demand for their leaf. At the same time, it should be borne in mind that one of the great factors which militated against the success of the large crop above referred to was the undoubted deterioration in quality which unfortunately was allowed to take place.

The farmers sacrificed quality for quantity, and to a very large extent had themselves to blame for the trouble which they had in disposing of their tobacco. It is improbable that they would have been able to sell immediately the whole of their two million lbs., even had it been of first-class quality, but had it been better they would have experienced far less difficulty in doing so.

As regards the prospects of exporting tobacco from Southern Rhodesia at advantageous prices, it is somewhat difficult for the Committee to express an opinion on this point, as it would be much better handled by the Director of Agriculture in Salisbury and the Trades Commissioner in London. Farmers are, however, cautioned against the production of a very large crop without having first taken steps to satisfy themselves as to their ability to sell elsewhere what they cannot dispose of in Rhodesia and the Union.

---

## Native Timber.

Rhodesia possesses in parts much very valuable native timber, but so far this has been very little exploited.

Rhodesian teak and mahogany are fairly well known, and a great deal of excellent and handsome furniture has been made from these woods and some really first-class results can be seen in Bulawayo.

The Municipal Council Chambers will show anyone interested in the possibilities of native timber what can be done in this direction. The panelling and furniture of the various rooms are all constructed from Rhodesian teak, and the effect produced is very much finer than a similar class of work carried out in Indian teak.

The Committee is informed that certain furniture manufacturers in Cape Town would use Rhodesian teak and mahogany in preference to similar woods imported from overseas if the former could be landed in their yards at about 8/- per cubic foot.

Much more use could be made of it than is the case in Rhodesia at present if architects would, for instance, regularly specify native wood for doors and door frames, etc. These could be manufactured in quantities locally at little over the cost of imported Swedish doors, and would have the advantage of never requiring painting. All that is necessary for their preservation is an occasional rubbing down with oil.

The following note from the Rhodesia Railways on native timber is of interest:—

> The only uses so far to which native timber has been applied on the Railways in Rhodesia have been for mileage posts and sleepers, and our experience up to the present has only extended to teak from Sawmills. This we have found to be practically free from the ravages of white ants where any vibration obtains, and even where not subject to vibration it is fairly free. As an instance we have mileage pegs now in the road which were put in in 1902.
>
> In our opinion, however, Southern Rhodesia teak is not so suitable for Railway purposes as other timbers such as "M'Koosi" timber from Northern Rhodesia, timber from Portuguese territory near Beira, and sleeper timber from the Congo, owing chiefly to its brittle nature and shortness of the grain. There are many purposes, however, to which it could be put where bending stresses are not involved, and for furniture, etc., it gives a very handsome finish, though a little difficult to work.
>
> Comparative breaking and deflection tests were made as between Southern Rhodesia teak and "M'Koosi" timber, with the result that the latter showed practically similar deflections but slightly greater breaking stresses. The teak, however, broke practically without any warning, while the "M'Koosi" even after fracture carried the load without actually breaking in two. We also find that "M'Koosi" timber for furniture works very much easier than Rhodesian teak; in fact almost as easily as Indian teak, and takes a very fine polish.
>
> There is another class of timber with which we have experimented, which was obtained near Victoria, in Southern Rhodesia. This, so far as sleeper tests are concerned, gave the best results of all, but owing to being unable to get a guarantee for sufficient quantities we have so far been unable to make any use of it.
>
> The Rhodesia Railways are now making arrangements for a fairly extensive use of timber sleepers from Northern Rhodesia, Congo, and Portuguese Territory.
>
> In connection with the timber from near Beira, we may say that this is being used very considerably there for the purpose of boat-building.
>
> We are of opinion that there is a considerable useful future for all the above-mentioned timber. We have already put in the road, as an experiment, three-quarters of a mile of Southern Rhodesia teak sleepers.

The comparative weights of these various timbers per cubic foot are as follows:—

| | |
|---|---|
| Southern Rhodesia Teak ... ... ... ... ... ... | 60 lbs. |
| Northern Rhodesia "M'Koosi" ... ... ... | 71½ ,, |
| Portuguese Territory Timber ... ... ... ... | 70 ,, |
| Congo Territory Timber ... ... ... ... ... ... | 66¾ ,, |
| Victoria "Mubuzhi" Timber ... ... ... ... | 69 ,, |

Another class of timber in Northern Rhodesia has recently been used for making a very excellent quality of pick and hammer handles. Some of these have been tested by us and have been found to be superior in appearance and toughness to the imported articles and compare favourably with those produced at Knysna. This timber is known locally as Mangura.

The whole of Rhodesian requirements in this respect can probably be met from this source.

A local firm which is interested in the native timber of Northern Rhodesia has supplied us with the following note on the subject :—

Rhodesian Teak or Redwood (native name " iKusi ").—This wood is well-known and is used largely for work in contact with the ground, as it resists the attacks of insects, and anywhere where a hard and durable timber is required. It is the most abundant of all the native hardwoods, and especially suitable for converting into railway sleepers. It is obtainable up to 3 ft. in diameter and 24 ft. in length, but straight sticks of over 15 ft. are uncommon.

Rhodesian Mahogany (Matabele name " Umcheve," Barotse name " Manzauri ").—A wood well-known as suitable for cabinet making and joinery, not so hard as the teak and longer in the grain, usually handsomely figured. This is an evergreen tree, most commonly found in Barotseland but widely distributed in the sand belts. It is usually of very crooked growth and the older trees are seldom sound. In girth it attains to the same size as Teak but is usually shorter, a straight stick 15 ft. long being the exception.

Blood Wood (Matabele name " Umvagazi," Barotse name " Mukwa ").—This wood is commonly known amongst the Barotse traders as " Paddle Wood," as it is used exclusively for making paddles by the natives of the Zambesi region. It is also used for building the boats used by traders on that river.

This timber is a first-class wood for such purposes as joinery and cabinet work, and for these uses is gaining an increasing reputation in this territory under the Barotse name of " Mukwa." It is usually found in single specimens or small groups widely dispersed through the sand belts. The tree has a ring of white sap wood about 3ins. thick and the heart, which is the valuable part of the tree, is of a dark colour ranging from brown to red. In diameter it seldom exceeds 30ins., and sticks 20ft. long are the exception, usually 10 to 15 ft. is all that can be commercially used.

To get the best results the log should be seasoned in running water for two or three months.

" Mangura."—This is the Barotse name for a wood of yellowish colour and tough, fibrous nature, of almost exactly the specific gravity of American Hickory and equally suitable for the manufacture of handles, spokes, etc. This tree grows in the more inaccessible parts of the Barotse Plateau, in some localities almost to the exclusion of other timber. For commercial purposes this tree seldom exceeds 18ins. in diameter. Old trees of much larger dimensions are not uncommon, but are invariably rotten in the heart.

Owing to cattle sickness and other local causes, this timber is commercially inaccessible for the time being, and it will probably be twelve months before any regular supplies are procurable.

" Mashuma " (Matabele name), " Machingi " (Barotse name).—A timber of pinkish colour and tough fibre, suitable for wagon building and similar purposes. Growing only along water courses and on ant heaps, this wood attains a considerable size in the Zambesi Valley and can be obtained in lengths of 20 ft. and a diameter of 30 ins.

There are also a number of white woods, more or less soft, few of which, however, grow in straight enough sticks to be of commercial importance. One would appear to be suitable for the manufacture of Wood Meal used in the manufacture of explosives, and possibly various uses may be found for others.

There are also a large number of the " Mahogany Bean " trees that produce a species of timber resembling true mahogany but without much figure. Various species of Acacia also attain considerable growth, including the " Knobby Thorn " (Barotse name "Makotakota") and another for which we know no other name than " Mahota "—this latter is a valuable timber for many purposes in wagon work. Further, ' Mangwe " (Matabele name) " Muhonon " (Barotse name) grows to large sizes, some logs being as much as 3 ft. in diameter and 24 ft. long. " Masheshi " is another wood, from which cart and wagon naves equal to any imported can be made.

In addition to the timbers mentioned there is a host of hardwoods producing poles suitable for pit props and similar purposes, such as " Mopani." Of the names of most of these we are at present ignorant.

The Committee has examined hammer handles made from Mangura wood. These are in every respect equal if not superior to imported handles.

It is hoped that the firm concerned will soon be in a position to supply the Rhodesian market with this article. The same firm is at present experimenting with the manufacture of Wood Meal, which is largely used in the manufacture of dynamite.

The following identifications of trees mentioned are taken from C. F. H. Monro's paper, "Some Indigenous Trees of Southern Rhodesia." Proc. Rhod. Scientific Association, Vol VIII. (1908):—

"iKusi"—Rhodesian Teak or Redwood: *Baikiaea plurijuga.*
"Mubuzhi"—mBuze: *Brachystigia* sp. probably *randii.*
"Mashuma": *Diospyrus* sp.
"Mahogany Bean"—Rhod. Mahogany: *Afzelia cuanzensis.*
"Knobby thorn": *Acacia nigrescens.*
"Mangwe": *Terminalia sericea.*
"Mopani": *Copaifera mopani.*
"Umvagazi": *Pterocarpus angolensis.*

---

## Explosives.

Nitro-glycerine and nitric acid are common to the manufacture of both blasting explosives and war propellants; in fact, all propellants classed as cordite, T.N.T., melinite, etc., used in this great war are manufactured from bodies such as cotton, glycerine and coal tar products, by treating them with nitric acid.

As these notes are principally concerned with high explosives, it may be as well to mention that glycerine forms the base of the present-day explosives used in the mining fields of Africa. Glycerine is a by-product of the manufacture of soap and, at one time, was allowed to run waste down the gutters. With the invention of high explosives its value was soon realised, and to-day it commands a very high price indeed. One of the changes brought about by this war is that, whereas in the past the supply of glycerine was dependent on the quantity of soap produced, soap factories are being erected to-day with the express object of producing glycerine, soap forming the bye-product.

South Africa is fortunate in having three high explosives factories, but unfortunate in the fact that raw materials for the manufacture of nitric and sulphuric acids, collodion cotton and nitro-glycerine have practically all to be imported.

It will readily be realised that the demand for propellants on the part of the Allies has been colossal and is becoming increasingly so, with the inevitable result that the manufacture of blasting compounds has been conducted under almost insuperable difficulties. Early in the history of the war the Imperial authorities set about husbanding their resources, and instructions were issued to all explosives manufacturers to seek the co-operation of the mines by getting them to use explosives having less nitro-glycerine contents. The Imperial authorities have all along very fully recognised the necessity for keeping the mines of South Africa going, but their first consideration is to protect the position of the men in the trenches by affording them a plentiful supply of shells.

The explosives manufacturers of South Africa promptly met the position and showed their ingenuity and resource by economising greatly in glycerine and in being able at the same time to place on the market explosives containing less nitro-glycerine contents, but which in many cases are equally as effective as the standard explosives—blasting gelatine and gelignite.

As these "substitute" explosives (as they are termed) contain less nitro-glycerine, they are less costly to manufacture, with the result that they can be sold more cheaply. A mine, therefore, which uses one of these substitutes in place of the standard explosives will not only reduce its working costs but will also assist in the general scheme of reducing, during the war, the commercial consumption of nitro-glycerine to the lowest possible limit, as desired by the Imperial Munitions Minister.

An appeal along these lines was made to the mines of Rhodesia over a year ago, and as a result such substitute explosives are now in very general use throughout the territory.

In some cases these substitutes have been found to suit the conditions of working so admirably that even after the war they are likely to be preferred to the old standard explosives.

Many of the Rand mines are also using these explosives, and as a result the mines of South Africa are setting free large quantities of nitro-glycerine for the manufacture of high explosives for shells. It may be safely claimed that Rhodesia led the way in this important matter.

## Leather and Hides.

Very large quantities of hides and skins are regularly exported from Southern Rhodesia.

In 1915 the value of such exports was over £38,000.

During the same year tanned leather was imported valued at about £4,500, and leather manufactured into boots, shoes, slippers, saddlery, etc., valued at over £30,000.

That there are possibilities of a successful local industry in the manufacture of leather is evidenced by the fact that the establishment of a local tanning factory has lately been seriously considered. The gentlemen concerned in this state there would be no necessity to import tannic acid, as raw material of very first-class quality for tanning purposes can be procured locally at reasonable prices.

A certain amount of leather is made on a small scale by one or two farmers, but this is generally for their own use.

The prospects of a successful industry in this connection appear to be worthy of investigation, but if a factory is started an absolute essential for success would be that no leather should be turned out except that which is equal in quality to the best imported article.

The Union of South Africa in 1915 imported tanned leather valued at over £230,000 and leather manufactured into boots, shoes, saddlery, etc., valued at over £840,000.

During the same period they exported hides valued at nearly £1,700,000.

## Coal Bye-Products.

The Wankie Colliery is unfortunately not at present equipped for the recovery of any bye-products from its coal. While a very large amount of coke is manufactured monthly, the original furnaces were of the bee-hive type, from which no bye-products are recoverable. In a more recent type installed the bye-products are still consumed, but the heat is utilised for coking the coal, and also for steam generating purposes.

Apparently the only prospect of success in the recovery of bye-products from coke-making is in the recovery of all of them. A large amount of coal tar could be used annually in road-making in our various towns and for other purposes, but it would not be profitable to instal special coke ovens for this, and under existing conditions there is no early prospect of a profitable industry being started for bye-products recovery.

It is of interest to note that a large quantity of sulphur is contained in the rejects from the colliery washeries. This sulphur cannot, however, at present be concentrated and railed to the dynamite works in the Union at a profit, but should the Colliery at a future date instal a bye-product plant, the article would probably be used for the manufacture of sulphuric acid.

The Wankie Company manufactures first-class quality fire bricks and special shaped bricks for furnace work.

There appears to be room for expansion in this trade, for instance, in the manufacture of assay crucibles, liners, etc. A small quantity of crucibles were moulded by hand a few years ago and tried in the Standard Bank laboratory, Bulawayo, and it was understood they were found to be thoroughly satisfactory as to quality but owing to the method of moulding they were not so homogeneous as the imported crucible.

Up to quite recently sewage pipes were mostly manufactured from fire clay, but these are now almost entirely superseded by stoneware pipes, which are much superior. The Wankie Colliery might, however, be able to compete in the manufacture of the pipes which may be required for the proposed Bulawayo Sewage Scheme.

## Notes on Antimony Ore in Southern Rhodesia.

So far as we know, the occurrence of antimonite (antimony sulphide) in this Territory may be divided into two types:—

(1) The sporadic gold-bearing type characterised by sporadic distribution in quartz-veins and "schist bodies." This has a granular texture. It forms strings, patches and large pockets, or it may be disseminated through a schist body in the form of minute crystals. In the last-named instance it has been found that the mineral is the double sulphide of lead and antimony (jamesonite).

(2) The type which forms definite veins sometimes free from quartz. So far this type has not been found to contain gold. It has a coarsely-bladed structure resembling that mined in Japan. An example of this type is afforded by the Modern Claims, $4\frac{1}{4}$ miles south-east of Gatooma. This is a vein of coarse-bladed antimonite weathering to a pale yellowish ochre which very closely resembles country rock. The vein is about six inches wide and dips westerly at 60°. After sinking about 10 feet the vein was found to contain no gold; consequently it was abandoned. It is again being opened up as antimony ore.

At times when the price of antimony is high, as it is now owing to the unusual demand created by its use as a munition metal, it should be highly profitable to recover both types of ore provided reasonable transport charges obtain.

But at normal times only the auriferous type among the deposits known in Rhodesia may be expected to be profitably exploited as a by-product in gold extraction.

Antimony ore is distributed through the central part of Southern Rhodesia in the belt of country extending from Hartley to Belingwe and from Gwelo to Selukwe; in this belt it occurs most abundantly around Gatooma, Que Que, and Lower Gwelo.

It is sparingly present in many mines, where, in most instances, it is not worth consideration as a source of antimony.

In other mines where it forms patches or pockets, such as in the ore-bodies of the Do-Me-Good (Gothic and Pagamesa), Globe and Phœnix, Petrol, Motor (where the ore contains about one per cent. of metallic antimony, although there are pockets of antimonite exceeding five feet across), Inez, Faugh-a-Ballagh (Hope Fountain, near Bulawayo), etc., it may be and has been picked or concentrated for export.

At those mines where large tonnages of ore are handled and the concentrate roasted, it may be found profitable to collect the antimonial fumes in a chamber in the same way that arsenic fumes are collected.

Two shipments of antimony ore were recently made from a mine in the Lower Gwelo district, but the results returned were far from satisfactory. On the first lot a considerable loss had to be met, and on the second very little profit accrued.

The Committee communicated with the British South Africa Company in London on the subject, and the latter forwarded a letter from Messrs. H. Watson and Company relative to this, together with a *pro forma* contract and account sales. These shew fully how the value of antimony shipments should be calculated, and it has been thought advisable to publish the letter and figures quoted:—

> Regarding the subject of Antimony Ore, we send you herewith a *pro forma* Contract and Account Sales, which we think will give you all the information asked for with regard to this proposed business.
>
> In reply to the enquiries we would say:—
>
> (1) There is always a market for Antimony Ore, but, naturally, not such a great demand as there is at present owing to the quantity required for munition purposes.
>
> (2) The lowest percentage is 50%, although under special conditions, if the Ore is otherwise good and clean, even a little lower than this might be saleable, naturally at a lower price.
>
> (3) The present market price is 11/- per unit of Metallic Antimony.
>
> (4) & (5) Penalties and deductions are shewn on the *pro forma* Contract.

(6) As to whether it will be profitable to ship Antimony Ore depends upon the cost of production and bringing it to this country, and this is a matter which only the shipper can decide. We may say that at present prices the Bolivian mine owners find it profitable to ship, and we are getting thousands of tons monthly from that country.

Yours faithfully,
(Signed) H. A. WATSON.

It is clear from the above that the ore preferred is one as free as possible from arsenic and lead, and it should preferably contain not less than 60% metallic Antimony.

Should the grade of any ore body be much lower than this a cheap type of furnace might be built to produce the Sulphide in a more concentrated form, or it might be found possible to produce metallic Antimony. Metallurgical advice should, however, be first taken.

## PRO FORMA CONTRACT.

K.30 & H.20, Exchange Buildings,
Liverpool, 18th April, 1916.

WHOM IT MAY CONCERN,—

We have this day sold for you the following:

SULPHIDE ANTIMONY ORE
say 100 tons.

on the undermentioned terms and conditions:—

*PRICE:* 11/- per unit, less 2½%.

*DRAFT:* 12 lbs. per ton.

*DELIVERY:* C.I.F. Liverpool or *ex* ship London, buyers' option, with the usual terms for those ports. Destination to be declared later. Name of steamer to be declared within one week of sailing.

*PAYMENT:* In case of London delivery, 14 days after delivery to barge. If prepayment is required, 14 days' interest at 5% must be allowed. If Liverpool delivery, 14 days from Sampling.

*PENALTIES:* *Lead:* Up to 3% free, with an allowance to buyers of 5/- per ton of Ore for every one-tenth of 1% over .3% up to 1½%.

*Arsenic:* .1% free, with an allowance to buyers of 7/6d. per ton of Ore for every one-tenth of 1% in excess of .1% up to .5%. Should the Ore fall below 60%, an allowance to be made to buyers of 3d. per unit down to 55%. If below and down to 50% an allowance of 6d. per unit. If above 60% an allowance to be made to sellers of 3d. per unit.

*Brokerage:* 1%.

Yours faithfully,
(Sgd.) H.A.W.

PRO FORMA
ACCOUNT SALES OF ANTIMONY
SOLD FOR ACCOUNT OF MESSRS. THE BRITISH SOUTH AFRICA COMPANY.

---

PAYMENT: Cash 14 days from sampling.

| | t. | c. | q. | lb. | | | | |
|---|---|---|---|---|---|---|---|---|
| By Sale | 100 | 0 | 0 | 0 | C | | | |
| | 1 | 0 | 0 | 0 | Moisture, say | 9 | 1 | 4 |
| | | | | | Draft 12 lbs. per ton | 10 | 2 | 24 |
| Assay | | | | | | | | |
| Antimony 60% @ 11/- per unt, £33 per ton | | | | | | £3,267 | 0 | 0 |
| 2½% discount | | | | | | 81 | 13 | 6 |
| | | | | | | £3,185 | 6 | 6 |

CHARGES.

| | | | |
|---|---|---|---|
| Freight | @ | | |
| Master porterage | @ | | |
| Dock and Town dues | @ | entry | |
| Cartage & Porterage to yard tons | @ | | |
| Telegrams, postages and petty expenses | | actual | |
| Cost of Assay Anty. | | £1 | 1 0 |
| Men's time attending landing, whg. & dly. | | 1 | 5 0 |
| Ore yard charges | | | |
| Attending weighing, sampling, &c., @ 1/- | | 5 | 0 0 |
| Brokerage £3.185 6s. 6d. @ 1% | | 31 | 17 0 |
| Interest on freight, &c., £ days @ 5% | | | |
| | | £ | |

E. & O. E.

LIVERPOOL, 18th April, 1916.

(Sgd.) H. A. WATSON.

---

## Barytes.

The occurrence of masses of Barytes (barium sulphate) has been known for some time in the country west of the railway between Que Que and Hunter's Road Siding. This has recently been examined by the Geological Survey and found to be of considerable extent.

One of the largest masses noted is more than 300 feet long and averages about 20 feet wide. Assuming a downward extension of the Barytes exposed of only 3 feet, the amount in sight in this one body exceeds 2,000 short tons. Quartz is the commonest impurity, but it appears possible to select large bodies of pure crystalline barytes suitable for all the purposes to which barytes is applied.

The pre-war price of barytes in England was only 25/- a ton for ore containing 96% barium sulphate and not more than 1.5% of silica, but it is probably much higher now, since barium sulphate as a chemical is quoted at £5 10s. 0d. a ton in London. There are possibilities of a local demand for the mineral for use in the paint trade, and enquiries are being made as to the demand for it in the Union of South Africa, where the mineral might be applied to various uses.

It is thought that an increased local demand might justify the quarrying of the mineral. The deposits lie within two miles of Gado Siding.

---

## Graphite.

Several deposits containing graphite are known to occur in the Territory, and some appear to be of large size. Although a sample sent to England by the Geological Survey for valuation was reported on unfavourably for export, it is probable that this graphite could be manufactured locally and replace the imported graphite compositions used for packing and lubrication. Practical tests are now being made on local material with a view to producing a dry flake graphite and a graphite paste or antifriction grease. If these tests are successful, the deposits will be examined to ascertain the probable quantity of graphite available.

---

## Alkali for Soap Manufacture and Other Purposes.

The manufacture of soap requires a caustic alkali: potash for soft soap, soda for hard soap. Soft soap is already manufactured on a small scale in Bulawayo with imported alkali. As there are no known deposits of alkali salts in Rhodesia of a size and character suitable for industrial production, and as the manufacture of alkali from the felspars of the granites or from other alkali-rich minerals is not yet a business proposition, the local production of alkali from a

mineral source is impracticable. Pearl-ash (crude potassium carbonate) may, however, be easily extracted from wood ashes, which contain an average of 10% of potash. Many mines in this country use large quantities of wood fuel. The ashes, which are now thrown out, might be utilized for the extraction of pearl-ash. Mr. J. A. T. Walters, Government Agriculturist and Botanist, states that the stalks of the sunflower are burnt extensively for this purpose in Russia. As the seeds of the sunflower are an increasing agricultural product, it might be possible to make use of the stalks now being wasted. Caustic potash is prepared from pearl-ash with the aid of lime, and has many other uses besides that of soap manufacture.

Inquiries are being instituted *re* the possibilities of the extraction of potash from (1) Ashes from mines using wood fuel, and (2) Sunflower stalks.

---

## Lead, Litharge and Nitrate of Lead.

Nearly all the lead used in this Territory is in the form of Acetate of Lead, Nitrate of Lead, Litharge and pigments. Prior to the outbreak of war, Acetate of Lead was used in all gold-mining cyanide works.

As lead is a very necessary requisite in war, stocks of Acetate of Lead soon became very low. On the initiative of Mr. Cullen, of the Modderfontein Dynamite Factory, certain experiments were carried out in the manufacture and use of Nitrate of Lead.

These experiments were thoroughly satisfactory and proved that Nitrate of Lead is an efficient substitute for the Acetate in all operations for the extraction of gold in cyanide plants. The Modderfontein works then commenced manufacturing Nitrate of Lead on a commercial scale, originally using scrap lead which was available in the Union.

Since then, however, lead has been regularly purchased for this purpose from the Broken Hill Mine, Northern Rhodesia. This mine has for about twelve months been producing about 100 tons of pig lead per month. The quality is very good, assaying from 98 to over 99 per cent. of lead. At present it is all shipped to England with the exception of that sold to Modderfontein Factory.

After finishing up any existing stocks, no mine should continue to use Acetate of Lead in its cyanide works, as the Nitrate is much cheaper and at least equally efficient. When normal conditions become resumed after the war, Nitrate of Lead is still likely to remain cheaper than Acetate; therefore this industry should become firmly established.

Another industry which will probably be started soon is the manufacture of Litharge. This is used in large quantities by the gold mines and has been entirely imported from overseas. The lead smelted at Broken Hill (Northern Rhodesia) is of very suitable quality for making this commodity, but inquiries instituted shew that the Directors of the Company are not at present able to consider the erection of plant for its production.

The Modderfontein Factory in the Union will, however, in all probability instal a plant for this purpose at an early date, and should be able to easily supply all South African requirements at a considerably lower price than it can be imported for.

It is satisfactory to know that if Rhodesia does not produce this article it can provide the raw material necessary.

---

## Cotton.

Cotton was grown on a small scale in Southern Rhodesia from 1904 to 1906, but without satisfactory results. The rainfall was insufficient in the early part of the season, the cotton developed slowly, and was finally ruined in June or July by ground frosts.

In Northern Rhodesia plantations were started in 1907 in the Kafue and Broken Hill districts, and later in the Luangwa Valley. For the last five years the production in bales of 500 lbs. has been as follows: 54, 171, 461, 454, 255. The world's production is approximately 18 million bales.

Cotton will grow in almost any soil under favourable climatic conditions. What these conditions are is best shewn by a short study of the climate of the American Cotton Belt, where about 70% of the world's cotton crop is grown.

Cotton requires:—

(1) A fair and well distributed rainfall during the five months of its growth, and dry weather during the following maturing season.

(2) A considerable amount of heat.

(3) Much sunshine, especially during the latter half of the growing season and whilst maturing.

Rainfall.—An analysis of 24 station distributors throughout the Cotton Region from the 87th degree of Lat. N. to the Gulf of Mexico gives the following averages for the five growing months:—

| | 1st Month ins. | 2nd Month ins. | 3rd Month ins. | 4th Month ins. | 5th Month ins. | Total |
|---|---|---|---|---|---|---|
| From | 3.7 | 3.7 | 3.8 | 3.8 | 3.1 | 18.1 |
| To | 4.5 | 5.0 | 4.9 | 5.6 | 5.7 | 25.7 |

Throughout Rhodesia the rainfall is well above these figures except on the Limpopo Valley, as is seen from the following table:—

| | 1st Month ins. | 2nd Month ins. | 3rd Month ins. | 4th Month ins. | 5th Month ins. | Total |
|---|---|---|---|---|---|---|
| Bulawayo | 3.7 | 5.1 | 5.7 | 3.9 | 2.6 | 21.0 |
| Salisbury | 3.8 | 5.9 | 7.5 | 7.3 | 4.6 | 29.1 |
| Victoria Falls | 2.0 | 5.4 | 6.5 | 6.5 | 3.6 | 24.0 |
| Monze, N.R. | 3.5 | 5.8 | 7.5 | 6.3 | 3.2 | 26.3 |

The rainfall in Rhodesia is therefore quite sufficient, though perhaps not so well distributed as in the States. The heavy falls we may get in the middle of the season are apt to be highly injurious to cotton crops, as was seen especially in 1908-09 in the Broken Hill district. Continuous heavy rains made it impossible to keep the cotton clean. The first principle of successful cotton-growing is that the cotton must be kept absolutely clean.

Temperature.—The mean temperatures in the American Cotton Belt range as follows:—

| | 1st Month | 2nd Month | 3rd Month | 4th Month | 5th Month | Mean |
|---|---|---|---|---|---|---|
| From | 70° | 76° | 78° | 77° | 72° | 76° |
| To | 74° | 80° | 81° | 81° | 77° | 79° |

The mean maximum temperature of July throughout the Belt is from 88 to 92 degrees.

In Southern Rhodesia we have the following corresponding figures:—

| | 1st Month | 2nd Month | 3rd Month | 4th Month | 5th Month | Mean |
|---|---|---|---|---|---|---|
| Bulawayo | 72° | 72° | 72° | 70° | 69° | 71° |
| Salisbury | 70° | 70° | 70° | 69° | 67° | 69° |

The mean maximum in December, the hottest month of the growing season, is 82° in Bulawayo and 79° in Salisbury. The difference between the Southern Rhodesian Plateau and the American Cotton Belt is therefore very great, and certainly not in our favour.

No climatic return has as far as we know been published for Northern Rhodesia, but the following figures for Milanje (altitude 2,500 ft.), in Nyassaland, may be taken to represent the average temperature conditions in the Northern plateaux:

76, 73, 72, 72, 72 deg. Mean, 73 deg., with a mean maximum of 82 deg. in the hottest month.

Here also we see that the conditions on the plateaux are not quite favourable, a fact which may be noted from the reports of the Bechuanaland Exploration Company, wherein it is mentioned that the Broken Hill Plateau is apparently too cold for cotton growing, in consequence of which that Company tried plantations in the Luangwa Valley.

The deeper valleys of the Northern Territory, such as the Zambesi, Kafue and Luangwa Valleys, are quite as hot as the hottest parts of the American Cotton States, as may be seen from the following figures for the five same months at the Victoria Falls:—

Mean temperature: 76, 81, 75, 75, 74 deg. Mean, 76 deg.

Mean maximum in the hottest month, 93 deg.

Sunshine.—In order to thrive, cotton requires a great deal of sunshine, especially during the maturing season and the latter half of the growing season. During the maturing season we are better off in Rhodesia than in most cotton-growing countries, since we have at that time of the year an almost uninterrupted sunshine. On the other hand, during the growing season conditions are entirely to our disadvantage. Taking the middle latitude of the American Cotton Belt as 33°, we have for the five months approximately 2,000 hours of available sunshine. In Rhodesia, if we take 15° as the middle latitude, the available sunshine during the growing season is only about 1,800 hours, or a shortage of about 10%, and this would, if we consider the average percentage of sunshine which we get, be reduced by a further 10%. A study of distributors at 12 stations throughout the American Cotton States gives the following results: The average percentage of the available sunshine they get ranges from 57% to 75%, only two stations giving a lower percentage than 60%; out of 60 monthly averages analysed only 7 are below 60%, the lowest is 51%.

In Rhodesia we have few sunshine observations.

A five years' average for Salisbury gives the following data for the five months: 52, 50, 52, 44, 59. Average, 51.

Adopting these figures as repesenting the average conditions for Northern Rhodesia, we see that on the whole the amount of sunshine obtained throughout our possible cotton belt does not average more than about 920 hours, as against a range of from 1,040 to 1,500 in the American Cotton Belt.

What this difference may mean can be imagined from the fact that owing to our shorter sunshine mealies throughout Rhodesia take from 3 to 4 weeks longer to grow than in the American Cotton States.

It must be noted also that in the States planting may be started as soon as any danger from spring frosts is reasonably remote, since the ground is, owing to abundant winter precipitation, always in fair condition.

Throughout Rhodesia the moisture-exhausting dry season is a highly adverse factor, and if the rains are not sufficient in November there is always a danger that the slow-growing cotton may be injured by ground frosts in June or July. In 1909, in the Kafue and Broken Hill districts, what cotton had survived the disastrous rainy season of that year was ruined by ground frosts in June.

On the whole our conditions do not seem, from a climatic point of view, as good as in the States. They are, however, not such as to preclude success in cotton-growing, especially in the basins of the larger rivers of Northern Rhodesia.

The next all-important question is: "Will cotton-growing pay in Rhodesia?"

Statistical figures from a large number of sources representing different soils and different climatic conditions, in several of the American Cotton States, show on an average that one lb. of cotton costs 7.9 pence to grow in the States.

This figure includes besides the cost of production the following items: Depreciation of farm implements, cost of maintenance and interest on capital invested, all of which have, of course, to be debited to cotton if that is the staple industry.

The average price of cotton is 10d. per lb., and the average production per acre about 200 lbs. On this basis the average profit per acre is under £2. Whether this will or will not pay in Rhodesia is open to question.

In Rhodesia all the items that make up the costs debited to cotton are notably more expensive than in the States, save that part which is allotted to native labour, and this is an important item. Cotton requires considerably more labour than any other crop, and about 50% of its production cost is allocated to this in the States. Our black labour costs less, of course, but it is not nearly so efficient. In Southern Rhodesia, where native farm labour is about one pound per man per month, plus food, it is very unlikely that cotton could be grown profitably. In Northern Rhodesia, where the rate for this kind of work averages from 10/- to 15/- per month, experts seem to think that even this is too expensive for successful results.

Another point to consider is whether cotton farmers are likely to get anything approximating 10d. per lb. for cotton delivered at the nearest railway station. The Bechuanaland Exploration Company got in 1908 7½d. in London for their cotton. The Rhodesian Cotton Company got 9½d. or 10½d. for their cotton two

years ago in Liverpool. The estimated value for cotton exported from Northern Rhodesia during the last five years is given in the Customs returns as 6d. per lb. in the first year and only 4d. in after years, presumably free on rail.

From these considerations it would seem advisable for anyone who intends embarking on such an enterprise to postpone doing so till the B.S.A. Company have published a detailed report on the cotton-growing experiments which they have conducted in the Kafue district for the last few years.

Considerable weight is given to this conclusion by the fact that in spite of great efforts which have been made during the last 50 years or more to become independent of the American Cotton Market, the Americans still grow 70% of the world's cotton, whilst the balance of 30% is grown by India with 20%, Egypt 5%, and all other countries 5%.

In the Exhibition of 1862, 35 countries exhibited cotton, yet 10 years later only a few of these sent samples to the Exhibition of 1872, and even to-day, after twenty years of effort by the Manchester Cotton Growing Association and similar associations in France and Germany, the whole cotton crop of the world, outside America and India, does not amount to the Egyptian crop.

---

## Investigation of Economic Products of Indigenous Plants.

The Committee has given considerable attention to matters concerning the utilization of natural products such as fibres, tannins, timbers, etc., of Rhodesian indigenous plants.

The available information concerning these commodities, such as basket- and brush-ware materials, cork, edible fruits, grasses and trees capable of yielding fibres usable as paper-pulp, drugs, caoutchoucs, oils, dyestuffs and colouring matters, the aromatic or essential oils, waxes, resins, natural varnishes, gums, kinos, elemis, balsams, etc., is very scanty and incomplete considering the period of the British occupation of the Territory and the fact that the natives prepare and use many of the commodities named.

It is astonishing that such information as we have even is practically unapplied, and it is hoped the Director of Agriculture may soon be able to devote more attention to such products than has been possible so far.

A few examples, taken at random, of the economic possibilities of our native plants may be stated:—

In a report by the Imperial Institute on a sample of rubber collected from an indigenous fig-like tree in Southern Rhodesia, it is stated that the sample resembled the product of *Euphorbia Tirucalli*, but was superior, since it contained more caoutchouc and less resin (the analysis showed 28% of the former and 68.2% of the latter, whilst "Tirucalli" coagulum contained 15.7% and 81.1% respectively).

Now the average production of "Tirucalli" coagulum in Natal during 1913 was 25,000 lbs. monthly, valued in Europe at 8 pence a lb. for "mixings," etc. This rubber is stated to come up to 80% of the value of the best Para rubber, whilst the resin in the coagulum has also a specific value.

Of the Leguminous trees, from which it is estimated thousands of cases of commercial gums are annually exported to Europe from Nigeria, at least three are native to Rhodesia, including *Acacia Seyal*, which produces one of the best gums exported from Nigeria. A sample of the gum of this tree was valued at 30s. a cwt. in London in January, 1910.

In view of the scarcity of atropine and its allied alkaloids and the failure of continental supplies, the *Datura*, which thrives so well as a weed all over the country, might be expected to afford a crop that would be eagerly taken up by British alkaloid manufacturers.

Other examples are afforded by the tree *Trichilia emetica*, which supplies (from other parts of Africa) nuts that are worked in the Marseilles oil mills, the residual cake being sold as a manure; by *Ricinodendron Rautanenii*, which produces a seed stated to yield very large quantities of oil to a company formed for its exploitation in German East Africa; by the tree *Ximenia americana*, the bark of which is used for tanning and the seed-kernels of which contain 65% of an oil useful for soap and candle making; and by the palm *Hyphæne*, the nuts of which

have been favourably reported on by experts in England as "vegetable ivory" which would be taken up by button manufacturers and others.

It is felt that the possibilities of furthering the knowledge of the subject, and of establishing new sources of supply and therefore industries, should receive early attention by systematic investigation. It is highly desirable, too, that our knowledge should be in advance of our requirements.

This involves exhaustive collecting and observations in the field, the determination of material, chemical analyses, collection of information from the natives, experimental cultivation and trial under observed conditions, and enquiries from, and trials and commercial valuation by, technologists, manufacturers and specialists abroad. Further, when useful facts are established the community must be persuaded and encouraged to apply them.

It is therefore obvious that the work cannot be carried out by individual private effort, although it is acknowledged that useful work has been thus accomplished by local botanists, more particularly on the purely botanical side—collecting, identifying and describing.

It is naturally the case that fair trials or examinations cannot always be expected from samples casually submitted for examination. Such samples are often collected at the wrong season or in a bad year. They are generally imperfectly prepared and dirty, or of insufficient quantity for technical trial. And it must be borne in mind that under cultivation, and by selection and breeding, the yield and quality of the valuable products will often be increased.

The officials of the Government Agricultural Department in Salisbury have conducted valuable (but not exhaustive) investigations on the subject from time to time. They have also established a herbarium, as has the Rhodesia Museum. But owing to the fact that the Agricultural staff has always had more work than it can cope with concerning established crops, it has been repeatedly and regretfully acknowledged in their reports that the subject under discussion has received much less attention than they desire to give to it.

It is therefore suggested and strongly recommended that the Government create a branch of the Botanical Division of the Agricultural Department for the purpose of carrying out the investigation of the economic products of indigenous plants.

---

## Chromium Ore.

The chrome-iron quarried at Selukwe, together with that mined in New Caledonia, has been the chief source of the world's supply of chromium for some time past. The output from the Selukwe quarries is increasing, whereas the supplies from most other countries have been decreasing. This state of affairs is likely to continue, whilst the demand for chrome-iron ore is almost certain to increase. It is therefore an opportune time to take stock of our resources, and to exploit them further.

There are two distinct sources of chromite in Rhodesia. The most important is that exploited at Selukwe. This occurs in the Talc Schists and is largely in the form of "pockets" or lenses, which commonly reach considerable size and form clusters. This group of deposits has been described in detail by the Geological Survey. Another occurrence of this type is known in the Victoria district, in the neighbourhood of the Asbestos quarries. It promises to be important, but is not yet worked. It is likely, too, that the Talc Schists in other parts of Rhodesia may be found to carry bodies of chromite.

The second source of chromite is the Great Dyke, which occupies a narrow strip of country stretching from Belingwe through Selukwe, Rhodesdale and Makwiro to Umvukwe. The patches of peridotite and serpentine in the Great Dyke contain thin patches of chrome-iron ore, which may become economically important.

The abundance of high-grade ore available makes it unnecessary to mill and concentrate the poorer ore, as is done in Canada and the United States. But when the high-grade deposits become exhausted it may be found profitable to treat the still more abundant low-grade ore and even the alluvium in places.

It may be mentioned here that platinum is associated with chromite in other parts of the world, and 1½ dwt. ore is now being milled for the recovery of platinum in the Urals. It should be diligently sought in Rhodesia. The price is now 190s. an ounce.

## Copper and Sulphur.

The attention of prospectors is drawn to the following notes by Mr. H. T. Brett, General Manager of the Falcon Mine, Umvuma. From these it will be seen that copper ores averaging eight per cent. and upwards may now be disposed of at a profit, even if only in small parcels of 100 tons. Further, it will be gathered that there is now a local demand for pyrites containing not less than 35% sulphur. This ore should be as free as possible from quartz, and should be in as large lumps as possible, anything that passes through a $\frac{1}{4}$-inch screen not being required.

Mr. Brett writes:—

> The Falcon Mines, Limited, have a complete copper smelting and converting plant in operation, and are prepared to purchase gold and copper bearing ores, also any ore containing not less than 70% iron pyrites.
>
> At the present high price of copper an ore running 8% copper is worth about £10 a ton. If it is possible to pick the ore up to a grade of 20% copper, the ore would be worth £25 a ton. On both these ores a very handsome profit would be made.
>
> The treatment charges on copper ores vary with the composition. A silicious ore (one containing over 50% silica) costs more for treatment than a basic ore (one containing a preponderance of lime, iron and magnesia).
>
> It is advisable that the ore should contain at least 8% copper, and be located reasonably close to a railway route. An average sample of about 50 lbs. weight should first be forwarded, in order that a full analysis may be made, after which the owners will be advised definitely as to the purchase terms. Should the ore contain gold and silver in appreciable quantities, so much the better, as these metals are recovered with the copper.
>
> Although there are not at the moment any bodies of copper ore large enough or sufficiently developed to furnish any great quantity of ore of the requisite grade, yet a handsome profit is obtainable where anything up to one hundred (100) tons of such ore can be picked, even if the price of copper falls considerably below its present figure.
>
> Ordinary pyritic ore (pyrites and pyrrhotine) is required for the smelting plant for fuel purposes. It is advisable that in any samples forwarded the percentage of sulphur should not be below 35, equal to about 70% iron pyrites.

The general distribution of the known copper ores of Rhodesia is described by Mr. Zealley in the Ninth Annual Report of the Rhodesia Museum, 1910.

---

## The Local Production of Grindstones and Whetstones.

Grindstones and Whetstones are a class of imported article which might well be produced locally. The grindstones used in Rhodesia are imported from the United Kingdom and the United States. The local price of a two-foot stone is about 50s. The annual value of the present imports is not large. It is likely, however, that many a farmer goes in want of a grindstone, and many a miner pays an unnecessarily high price for his.

The sandstones and grits near the railway around Nyamandhlovu and Wankie are no doubt capable of supplying satisfactory stone for the purpose.

Even-textured massive sandstone or grit should be selected; of course, free from pebbles or concretions and from a cement of opal (such as the white sandstone of Thabasinduna). The stone commonly preferred is a fine-grained felspathic grit in which the quartz grains are held together by decomposed felspar.

There are many places in Rhodesia where rock suitable for preparing waterstones and oilstones (whetstones and honestones) may be found. An imported six-inch Wachita stone costs about 6s. in Bulawayo, whilst a nine-inch Turkey stone of inferior grade costs about 7s. 6d.

As a waterstone it is suggested that a trial be made of the pale-grey homogeneous flinty-looking felsite. Such a rock outcrops near, and occurs in, the mines at Eiffel Flats and in many other localities.

The harder jaspery red and grey types of felsite such as form the ranges of so-called banded ironstone at Que Que and in other parts of Rhodesia might be expected to yield oilstones as good as the best selected "Turkey Stone," "Arkansas Stone" and "Hindosti Stone," which they exactly resemble in thin sections under the microscope.

## Mica.

Sheet mica occurs in Rhodesia in many widely separated localities. It was occasionally pegged in former years, but none was ever exported, rumour saying that the mica was found to be too small in size or too poor in quality. At that time the minimum size accepted in the ordinary course of trade was a 4-inch square, whilst at the present time mica measuring two inches by three inches or even less is saleable. It is desirable, therefore, that the more promising mica deposits situated near railway routes should be re-examined. It is suggested that prospectors should send in samples to the Geological Survey for a report.

## Mineral Oils.

Mineral oil occurs in nature in commercial quantities in one of two ways: (1) as a liquid in the pores of rocks, (2) mixed with mineral matter as a bed or seam of oil-shale, from which the oil is obtained by distillation.

(1) The persistence of underground reservoirs of oil requires a porous rock to hold the oil and an impervious covering rock to prevent the oil reaching the surface in springs or its slow evaporation in the course of geological ages. For these reasons the "schists" and large masses of igneous rock like granite may be ruled out as not oil-bearing. Amongst the stratified rocks an anticlinal or dome structure, wherein impervious shales overlie porous sandstones or limestones, is the most favourable for oil reservoirs. In Rhodesia the belts of metamorphic rock or "formation" and the granitic masses not being oil-bearing, we are left with the stratified rocks of the Karroo system, which contain the coal measures. So far as the geological structure of the Karroo rocks is known, they are disposed in broad shallow basins not favourable to the formation of oil reservoirs. Anticlinal structures have been described in N. Rhodesia by Mr. A. J. C. Molyneux, but all the anticlines appear to be so denuded or to have such a "pitch" that they have no value as possible oil-reservoirs. It is not possible to point to any likely anticlinal structures in Southern Rhodesia, though small areas with this favourable structure may exist in the belt of country described below as likely country for oil-shale.

(2) Oil-shales as such are not found amongst the metamorphic rocks, for the reason that any severe metamorphism destroys them. There is no reason, however, why they should not be found amongst the sediments of the Karroo System. Bituminous shales are, in fact, known to occur in the Black Shale group, in which the Wankie Main Coal lies. This horizon and the higher one of the Madumabisa Shales, near the base of which the Wankie Upper Coal lies, appear to be the most likely situations for oil-shales. The main belt of country in which these horizons are to be found trends in a north-east and south-west direction through the Wankie and Sebungwe districts. The Victoria Falls railway line crosses the belt between Inyantue and Deka sidings. Followed to the north-west, the belt expands and includes most of the country between the Great Escarpment and the Zambesi River. The northernmost portion of the Lomagundi district, the Sabi coalfield in the Ndanga district and the Umzingwane and Massabi fields in the Gwanda district, should also be mentioned as areas where oil-shales might be found.

As it is probable that few prospectors in this country are familiar with oil-shale, it may be noted that the first rough test is made with a penknife. A good oil-shale will not fall to powder, but will curl up under the knife and give a brown greasy streak.

## Molybdenum.

Molybdenum is in particular demand at the present time for the manufacture of special varieties of steel. The marketable ores are molybdenite (molybdenum sulphide) and wulfenite (molybdate of lead). The latter mineral has not been discovered in Rhodesia. The former has been recorded from a number of localities, but nowhere in any quantity up to the present. Specimens in the Rhodesia Museum come from Glenville, near Bulawayo, from the Antelope Mine, and from the Kimberley Mine. It is also recorded from the Hay Mine and neighbouring properties. It has recently been discovered near the Umfuli River and in the country west of Gatooma. These latter discoveries are being prospected.

Molybdenite occurs in leaden grey flakes, which mark paper like graphite. It is usually found scattered in flakes and small nests through pegmatite dykes and veins, especially pegmatites with much quartz. Near the surface it is usually oxidized to molybdic ochre, a pale yellow earthy mineral, which resembles bismuth ochre. In New South Wales the rich occurrences of molybdenite which have been mined have the form of "pipe veins" and are situated near the edge of granite masses.

On account of its softness and flaky nature it has always been difficult to concentrate molybdenite. It is stated that these difficulties have been successfully overcome by the use of the oil-flotation process, and that ore carrying only ½% of molybdenite is being profitably worked in Norway. Concentrates containing 80 to 90% molybdenite are now valued at £5 5s. 0d. the unit. A 90% concentrate, therefore, is worth £472 10s. 0d. a long ton.

---

## Talc.

Talc is a mineral which has very many uses in the arts and industries, the prepared article being generally known as French chalk. It is quite a common mineral in Rhodesia, occurring in large bodies in a more or less pure form (soapstone). It has been found possible to start an export trade from the Transvaal to Europe since the war began, £8 to £40 a ton being received for the ground mineral according to quality. If a large body of pure talc-rock, which would require no treatment beyond grinding and bagging, could be found near a railway route, high railway rates would appear to be the only obstacle to the establishment of an export trade. The world's consumption of talc is increasing, and the United States, although the largest producer, yet imports the finer grades. Large and increasing quantities of talc are used in paper manufacture and in the preparation of cotton fabrics. For the former the fibrous variety is required, and it is known to occur in Rhodesia.

At the same time the local talc might replace the imported article in several directions. Talc is required in the manufacture of paints and distempers, and there is no doubt an opening for a local industry in this direction. It might replace the French chalk imported for use in the tyres of motor cars and bicycles, the demand for which, if not large, is persistent and increasing. Talc is the chief ingredient of many toilet powders, for which again the demand is permanent. If talc were produced locally it is very probable that other uses would be found for it, *e.g.*, in the Soap Factory, and in numerous other uses to which French chalk and soapstone are put.

---

## Tantalum Ore.

The presence of two tantalum minerals was noted in the Victoria tin field (about 35 miles east of Victoria) during the time that active prospecting was proceeding there in 1911. One of these—tantalite (niobate and tantalate of iron and manganese)—occurred in coarse radiating masses of heavy black crystals, which suggested that a fair quantity of the mineral might be present. Specimens seen weighed up to 3 lb. and were said to come from quartzose pegmatite veins. Nothing further has, however, been heard of the discovery; but it would appear worth while for prospectors in the district to devote further attention to the mineral.

Tantalite is a mineral of variable composition. It passes by insensible gradations from normal columbite (the nearly pure niobate) to normal tantalite (the nearly pure tantalate). Tin, zirconium and manganese are generally present, partly replacing one or other of the metals in the mineral. Tantalite contains up to about 80% of tantalic oxide, whilst columbite contains up to about 80% of columbic (niobic) oxide. The weight of the mineral is a serviceable guide to its tantalum content, since it increases with the percentage of that metal; thus columbite has a specific gravity of about 5.3, increasing to 7.8 as pure tantalite is approached.

It is not always easy to distinguish tantalite from tinstone, with which it is commonly associated, and it may not always be readily separated by gravitational methods.

Tantalum is used as a substitute for the carbon filament in incandescent electric lamps, tantalite being the chief source.

This is the only practical use to which the metal has, so far, been put. A few years ago the tantalum filament lamp promised to be in great demand, but it appears to have been superseded by other metallic filament lamps, notably the osram and tungsten filaments, which, although their lasting power is about the same, consume less power. Nevertheless, there is still a demand for the tantalum lamp. It is also known that tantalum can be used for hardening steel.

Columbite appears to have no commercial value at present.

Tantalite is treated by the British Thomson-Houston Company, and the firm of David Gething, Landore Copper Works, Landore, S.O. Glamorganshire, are buyers of the ore.

The price of tantalum ore fluctuates. The requirements a few years ago were stated to be not less than 60% tantalic oxide, not more than 3% columbic oxide, and freedom from chromium. Such ore was valued at about 10s. a lb.

---

## Tin

Tin was first reported in 1908 to occur in Southern Rhodesia near the Umniati River, together with copper, in a country of chlorite schist. In 1911 tinstone was found on a number of farms in the Enterprise district, about 25 miles east of Salisbury. Following this discovery, tinstone was reported from the neighbourhood of the Gem Mine in the Ndanga district, some 40 miles east of Victoria on the road to Melsetter. Shortly afterwards tinstone was discovered in the Mazoe district on the farms Hereford and Arcadia, and also on unalienated land about six miles south of Shamva.

In these three last fields the mode of occurrence of the tinstone differed from that at the Umniati River. The tinstone occurred as black crystals disseminated through pegmatite dykes, which had undergone more or less completely the alteration to greisen, so commonly found in association with tin deposits. Although no true alluvial tin deposits have been discovered, a considerable amount of what has been called "shed tin" is found in the soil on ground sloping away from the outcrops of the reefs, just as "shed gold" is found in relation to the outcrops of gold reefs.

The more promising reefs have been developed in each district. The distribution of the tinstone within the reefs has been found to be very irregular, there being no well-defined "shoots" or "pipes." It has been concluded that the extraction of the tinstone would not be profitable without a considerable reduction of present working costs.

---

## Tungsten.

Tungsten is in great demand at the present time for the manufacture of special steels. The Imperial Government have prohibited export from the British Dominions and have fixed a maximum price of 55s. a unit, a unit being 1% of tungsten trioxide ($WO_3$). The chief ores of tungsten are wolframite, which contains 76% $WO_3$ when pure, and scheelite, which contains 80% $WO_3$ when pure. Tungsten concentrates to be readily saleable should contain 65% or more $WO_3$. The value of a 65% concentrate at the maximum price is £178 15s. 0d. a long ton.

Wolframite has been found on the Sabi River, but its most important known occurrence in Rhodesia is west of Essexvale Station, in the Umzingwane district. Here it occurs in pegmatitic dykes, and lumps of it may be picked up on the surface over a large area. Extensive sampling with trial washings has recently been made on a bed of many thousand tons of rubble, but the grade has been found to be just too low for profitable working.

Scheelite is widely distributed in small quantities in the gold reefs of the country and may frequently be noticed in panning samples, particularly from those reefs lying in granite country. It is a point for investigation whether in many cases appreciable quantities of scheelite could not be saved as a by-product in the extraction of gold at a time when tungsten is in such urgent demand for munitions. In a few instances scheelite is known to occur in "visible" quantities. A promising prospect of this character is now being developed near Que Que. At the Scheelite King Mine, situated 9 miles west of Gatooma, the mineral occurs in lumps in a large quartz reef associated with a mass of fine granite. The scheelite was hand-cobbed and bagged, the output amounting to 46½ tons before the mine was closed down.

---

## Cement.

A local cement factory has been in operation near Bulawayo for about two years.

The process of manufacture throughout is very carefully supervised so as to ensure an even grade product. With the exception of some trouble in the early stage of manufacturing, this result has been regularly achieved. The raw material is automatically mixed and the mixture analysed every hour, and it can be safely stated that, from the precautions taken, a first-class grade of cement is regularly turned out.

It would seem to be equal in all respects to the best British imported article, and there appears to be no longer any justification for the use of the latter.

The following gives a fair average of results of tests and a comparison of its qualities with the British standard specification for cement:—

*NEAT CEMENT.*

| Date Made. | Tensile Strength per square inch. | | Residue on a Sieve, 180 x 180 | Initial Set. | Final Set. | Expansion Le chatelier. |
|---|---|---|---|---|---|---|
| | 7 days. | 28 days. | | | | |
| 1916 April 17th | 584 lbs. | 644 lbs. | 3 % | 45 min. | 4 hours | 2 m.m. |
| British Standard, March, 1915 | 450 lbs. | 540 lbs. | 14 % | Over 30 mins. | Over 3 hours, under 7 hours | 10 m.m. |

Faiga Hot Water Test—Sound.

The cement is sold in bags containing 187½ lbs.; thus two bags equal the contents of one cask as supplied by British manufacturers.

The finished cement is regularly subjected to all the tests required by the revised British standard specification for Portland cement, and the Faiga hot water test is also employed in addition.

On several occasions cement has been condemned when the actual fault lay not in the cement but in the other materials used. To ensure good and sound work the stone and sand used must be thoroughly clean. The ordinary river sand in this country, which looks quite clean and does not stain the hands when picked up, contains as a rule a fairly large quantity of alluvial soil. This

can easily be proved by washing a little in a pan. The broken stone used in concrete work should also be washed clean of any adhering soil or dust, as otherwise sound work can hardly be expected.

The price of local cement has not been affected by the war, and it is believed that a more extended use of it might be profitably made than is done at present.

The following, among many others, are some examples of its profitable utility:—

Sheep and cattle dips.
Cow sheds.
Stable and stock yard floors.
Cess pits.
Silos.
Foundations.
Fencing and telegraph poles.
Pavements and floors.
Kerbs and street guttering.
Dams.
Pipes and culverts.
Water, cyanide and other tanks.
Pig styes, troughs, etc., etc.

Pipes of large diameter and culverts can be made more cheaply of reinforced concrete than of steel.

A concrete floor can be put down at less cost than the ordinary wooden one. Failures with concrete floors sometimes occur, but in the large majority of cases these are due to settlement underneath. If before the floor is laid the ground is thoroughly well rammed, there is no danger of failure even with a comparatively thin floor. This is assuming, of course, that a proper mixture of concrete is made.

Concrete floors give full protection from white ants if laid in a continnous sheet before the walls of a house are erected. In such cases the concrete should extend beyond the walls outside.

For necessary and healthy ventilation a few air bricks are essential just above the floor.

Large tanks made of reinforced concrete can be constructed at a less cost than steel tanks. This refers particularly to cases where skilled labour is already available on the site and where timber for moulding can either be used for other purposes after the tank is completed or can be used for a number of successive tanks. Such tanks are easy to keep clean, and compared with steel are practically everlasting.

---

## Vanadium Ore.

The only recorded occurrence of vanadium ore in Rhodesia is at Broken Hill, where descloizite (hydrous vanadate of lead and zinc) and vanadinite (lead chloro-vanadate) are associated with the zinc and lead ores mined there. It is stated that several tons of vanadium ore lie in the dumps.

At Broken Hill vanadium ore is present to some extent in Kopjes Nos. 1, 2 and 3, but most abundantly at No. 3 and between it and the bone cave, at which point descloizite forms crystalline pockets nearly a foot across and compact seams and incrustations in the gossan. It has not been detected in the unoxidized ore.

Where it is concentrated in the gossan it might be easily hand-picked. Elsewhere it might be recovered in the treatment of the zinc and lead ore.

A little copper is present in the vanadium minerals, but no arsenic or phosphorus. The clean ore, therefore, seems well-adapted to most of the uses to which vanadium is applied.

The most important use of vanadium is as ferro-vanadium in the manufacture of vanadium steel. Vanadium exerts a powerful influence on steel, among the more important properties it imparts being the raising of the elastic limit and tensile strength, whilst it lessens the brittleness due to vibration and alternate stresses, and is therefore largely used in the motor industry and in gun barrels and gun shields. It is also utilised in bronzes, etc. Vanadium compounds are used medicinally, in photography, as mordants in printing and dyeing, as colouring agents in the glass industry, etc., and as catalytic agents in the manufacture of aniline black, sulphuric acid, etc. With tannin vanadium salts make a waterproof black ink.

The price of ferro-vanadium is steady at 14s. 6d. per lb. of vanadium content. Ore running 15% of vanadium pentoxide ($V_2 O_5$) sells now at about £40 a ton. Most descloizites contain about 20% of vanadium pentoxide, whilst vanadinite, the heavier mineral, contains about 18%.

Most of the vanadium of commerce is obtained in America, whilst the British Empire does not appear to contribute to the supply. It would seem worth while, therefore, to export the ore from Rhodesia.

---

## Engineering Workshops and Foundries.

There is a comparatively large number of engineering workshops throughout Rhodesia. The large majority have been erected on mines and are almost solely engaged in maintenance work for their own mining plants. A few of the larger ones have foundries attached to them, these being engaged in similar work.

The Railway Company have well-equipped workshops at Umtali and Bulawayo, and in the former, in addition to ordinary castings, they are able to successfully turn out crucible steel castings, and are in a position to execute outside orders for such.

Since the war started the output from all these foundries and workshops has increased very greatly and continues to expand, for every possible effort is being made to produce as many articles as can be manufactured locally, and so obviate the necessity of importing such requirements from abroad.

A fair number of workshops and a few small foundries are to be found in the larger towns, these being mainly engaged in repair work for the country generally, but a considerable amount of castings have still to be imported from the Union. The reasons for this are mainly due to our town foundries not being sufficiently well equipped for turning out large castings, and because more reliance can be placed on getting quicker delivery of sound castings from the well equipped foundries in the Union than from the comparatively small ones in our own centres. The amount of work turned out by our local town foundries hardly justifies the regular employment of pattern-makers and moulders, and it is only from a foundry which has sufficient work to regularly employ competent labour and keep its cupola going that uniformity in grade and quality of castings can be relied on; consequently Rhodesia has for the time being to get its requirements for large castings from outside its own borders. Costs obtained from some of the larger mines shew that when a foundry in Rhodesia has sufficient work to keep it constantly employed it can turn out castings at a price which compares very favourably with those imported from abroad or from the Union.

In our opinion there would be better prospects of success for a good foundry if, in a centre such as Salisbury, the various small foundries were combined rather than working independently as they do at present.

---

## Women's Industries.

The Committee was lately approached by a representative of the Bulawayo Women's Reform Club in the matter of obtaining certain information regarding the increase of prices for articles of ordinary consumption, etc. At the same time, it was mentioned that they would be very glad if we could advise them as to industries which might help some of their members to increase their incomes. This matter has been gone into by the Committee and others, who are aware that the Women's Club has during the past year done much in the direction indicated. It is therefore somewhat difficult for it to offer suggestions which have not perhaps already been under consideration. The following are, however, put forward as being worthy of investigation by the members of the Club and others throughout the country:—

According to the Principal of the Bloemfontein School for Home Industries, many women in the Union are, after some training, making good livings by doing skilled needlework, and she states that smocking and fine embroideries, children's wear, and the making of delicate lawns and laces into blouses and underwear, always bring good returns, provided the worker is wise enough to ask a fair and reasonable price, though she ought to be strong enough to refuse under-payment. A depot for the sale of such work has been established in the Union, and this

might be done in a smaller way in Rhodesia, but suppliers must be careful only to send good work, otherwise not only does the business of the depot suffer but also those who send their articles to it for sale. It is considered that work of this sort is far more payable than "small" dressmaking. Upholstering is another branch in which women are now doing good work in the Union, whilst the making of tweeds, serges and rugs, which is said to be far from difficult, has been found to be very profitable; but this latter is probably too advanced an industry for Rhodesia just yet.

The feathers of poultry are carefully collected by many women and used for the making of pillows and cushions instead of the unpleasant material which is largely utilised for this purpose at present. Home-made lemon-squash, well bottled, is another home industry that has met with success.

Locally-made pottery appears to have a good sale in the Union—also brasswork and copper-beaten articles of good design and workmanship. In some cases native woods, of which Rhodesia furnishes a wonderfully good variety, are worked up with the brass. Some rather fine hanging lanterns of this type for electric light were to be seen at the recent Johannesburg Agricultural Show.

Toys, such as dolls and golliwogs, etc., are being made by women and taken up by stores in the Union.

By finding markets for such productions as these and any others that can be turned out in Rhodesia the Women's Reform Club would, we think, be doing admirable work.

---

## Railway Rates.

It is a fact which needs no evidence to support it that the industries of the Territory cannot be developed without—

(1) Capital, the bulk of which must be imported, and

(2) Railway Rates which will encourage the Capitalist to embark on industrial enterprise.

In this connection it is pertinent to quote the following extract from the Report of the Union Commission of Enquiry into Commerce and Industries (U.G. No. 10, '12), issued in 1913. The remarks may be said to apply with particular force to Rhodesia:—

> Formerly the relation of raw materials and manufactured articles was not sufficiently considered; often the rate on the former was such as to prohibit manufacture inland. It can be said without fear of contradiction that the past policy retarded industrial development in the country, for cheap transport is the very life-blood of commerce and industries.

In the course of evidence the following striking statements were made:—

Mr. W. Ehrlich (President, O.F.S. Chamber of Commerce) asked what would be his definition of running the Railways on business lines, replied: "Anything that would tend to develop a country through the Railways would be good business." Further:—

> You used to carry coal to the Cape at ⅛d. per ton per mile and that was a paying rate, as otherwise the trucks would have gone down empty.
>
> Existing policy was to saddle the people inland with the cost of the Railways.

Durban Chamber of Commerce:—

> A specially low rate for export is recognised, otherwise you could not compete in the markets of the world. Nothing should be carried by the Railways at less than cost; you should pay the Railways the cost of service, but it is a different thing in exporting. There you come in contact with the markets of the world, and if you cannot compete in the markets of the world you cannot export.

Representative of D. Isaacs, Capetown, Furniture Manufacturers:—

> He had tried Rhodesian teak, and if they will bring it to him at the price he can buy Mahogany he will leave off importing the latter. Railage and transport work out at about 26/9 per 100 lbs., or somewhere about 150% on the value. The prime cost will have to be considered as well.
>
> Rhodesian timbers would have to be laid down in their store from 7/6 to 8/- per cubic foot to compete with the imported article. The last he purchased cost 12/- a cube and the freight was about 18/- per 100 lbs. If it cannot be got at the price it cost them to import teak (about 8/- a cube) it is of no use to them.

Similar remarks might be made in regard to practically all the items mentioned in the foregoing Report of the Committee, and would apply to cattle, leather, oil, fibres, fireclay articles, lime, and mineral ores.

In this connection it should be mentioned that since the above evidence was given the rates on timber have been reduced and stand at £3 7s. 8d. per ton in full truck-loads from Sipopoma Siding to Cape Town. This is equivalent to 3/5 per 100 lbs. Should small quantities be forwarded, the rate for this class of traffic would work out at about 7/10 per 100 lbs., equivalent to about 4/8 per cubic foot, assuming 1 cubic foot to weigh only 60 lbs. These rates, unfortunately, are still too high to enable Rhodesia to compete in this market.

That the mineral traffic of Rhodesia is capable of expansion under favourable freight charges is patent to all, but is clearly evidenced by the following returns of tonnage of minerals carried by the Rhodesia Railways:—

| | |
|---|---|
| 1911 ... ... ... ... ... ... ... | 225,755 |
| 1912 ... ... ... ... ... ... ... | 250,709 |
| 1913 ... ... ... ... ... ... ... | 250,737 |
| 1914 ... ... ... ... ... ... ... | 358,944 |

In the year 1914 the increase is chiefly attributed to coal, coke, copper, and chrome iron.

The Committee consider that they would be failing in their duty if they did not draw attention to the possibilities which exist in Rhodesia for the development of many industries if reasonable traffic rates were offered.

It is believed that the time has arrived for a full enquiry to be instituted by the Railway Companies in order to ascertain how far they can go to meet the hopes that have been expressed that an export trade should be built up and the country made more self-supporting. Certain of the directions in which enquiry might proceed are merely indicated below, in the hope that some of the existing limitations may be dealt with in a manner best calculated to foster local industrial progress.

A few instances which are worth quoting have been brought to the notice of the Committee.

(1) Railage on Ores.—No rate is fixed by the Railway Companies for the conveyance of ores and minerals. The principle in fixing such rates at the present time is to charge what the Railway Companies consider the mineral can bear. Applicants for a rate for the conveyance of ores and minerals are generally asked what the value of the ores may be, and the rate is based by the Railway Companies on such value.

The Committee maintain that the present system of fixing the rate *pro rata* to the assumed value of the mineral conveyed is not one which will encourage the development of the base mineral industry. It is, moreover, a manner of fixing rates which, while it may be considered by the owners of railways in other countries applicable to the situation on the principle that all traffic is supposed to carry the rate which it will bear, is inconsistent in Southern Rhodesia, where a royalty is charged by the owners of the minerals—whether the mineral can bear it or not.

In the interests of the country, its export trade and the Railways themselves, it is essential, in the opinion of the Committee, that rates for the conveyance of ores and minerals should be fixed at such a scale as will stimulate production. As in all public services the amount of the profit of the Railway should depend on the volume of traffic, and traffic has to be encouraged and built up by the granting, in the first instance, of the lowest possible scale of rates.

The rates for ores which have been in force for some time past on export consignments on the Union Railways are fixed at a scale which is about one-fourth of those charged in Rhodesia.

The population of Rhodesia is, of course, small as compared with that of the Union, but, even allowing for this, the Committee is of the opinion that Rhodesian rates are disproportionately high and impose limitations on exports.

In a consignment of Antimony, the particulars in regard to which have been before the Committee, £94 10s. 0d., or 1.35 pence per ton per mile, was paid in railage from Gwelo to Beira. Charges were calculated on the gross carrying capacity of the truck, and the consignor thus paid for two tons not conveyed. When it was ascertained afterwards that the enterprise had resulted in a loss, the Railway Company refunded about 25% of the rate which had been charged. The fact of the refund having been made does not, however, affect the contention of the Committee with regard to the general principles on which these rates are fixed.

To convey the same amount a similar distance in the Union, the Government of which obviously encourages the traffic in ores for export, would have cost about £19 5s. 0d., or about one-fifth of the amount charged by the Rhodesian system.

It must be remembered that articles carried for export have to compete with the outside markets of the world, and it follows that the Railways must carry at a low rate, or not at all. No investor is going to take the risk of embarking on any enterprise for the development of ores for export unless he has some assurance that he will be able to calculate on sympathetic treatment from the carriers.

The further point as to the charge made by the Rhodesia Railways, irrespective of weight, for the marked carrying capacity of the truck used, is drawn attention to as discouraging the shipping of small experimental consignments, and as penalising consignors in an unjustifiable manner.

Scrap Iron is largely used by foundries in Bulawayo and other centres. The minimum rate for this is 1d. per ton per mile in full truck loads. Smaller quantities are charged at 4th class rates, which works out at 45/- per ton for a distance of 120 miles, or 4½d. per ton per mile. For a distance of 300 miles the rate is £5 5s. 0d. per ton, equivalent to 4.2 pence per ton per mile.

In the Union the charge for conveying this scrap in full truck loads is ½d. per ton per mile in 10-ton lots up to 200 miles, and ¼d. (one farthing) per ton per mile for any remaining distance; while small lots of scrap are conveyed at ⅔d. per ton per mile for a distance of 120 miles and at 53/4 per ton for a distance of 300 miles, equal to 2.13 pence per ton per mile.

The result of such high charges on the Rhodesian Railways means an increase in the cost of castings to the mining industry and prevents the progress of local enterprise, as orders are naturally placed elsewhere.

It should be noted that a large proportion of scrap purchased by our Rhodesian foundries is bought in quantities of less than full truck loads.

Many similar examples might be quoted, but the above are sufficient to point to the necessity for a close investigation of the rates now in existence and of the general policy by which such rates are fixed.

---

## Mission Enterprise.

While the Committee fully recognises the excellent work that all the schools of the various missions are doing throughout the country, it is felt they could do more still in an industrial way, and the attention of the heads of these schools might be directed to such things as the making of rope, string, nets, baskets and pottery, for all of which there should be a very fair demand and of which the natives at one time produced quantities.

Since our occupation of the country, however, these and other native industries have declined very greatly and in some cases entirely.

It is hoped, however, that efforts may be made to restart them again, more particularly in Mashonaland, where the rope, nets, basketwork and pottery produced twenty years ago were of such good quality that a ready market was found for all that was offered.

In connection with this subject, an article sent to the Committee by Mr. G. Arnold, of the Rhodesia Museum, on the possibility of establishing an industry for the breeding of silk worms and the working up of their product is at present being looked into.

It is believed by the Committee that if the heads of all the missions working in Rhodesia were to take the matter of native industries in hand, much good might result.

---

## Small Workers.

### ECONOMIES FOR SMALL MINES.

A considerable number of small mines in Rhodesia are owned (or leased) and worked by men who have not had training in either mining, mechanics or metallurgy, and these few notes have been compiled in the hope that they may be of some assistance to such individuals in the economical working of their properties.

To assist in gaining access to or egress from stopes, timbers are often fixed between hanging and foot walls or short jumpers fixed in either wall. In many cases these are placed at inconvenient distances apart, making it awkward to climb out. A result of this is that a miner when blasting in such a stope has to use very long fuses to ensure his safety, whereas if a few extra timbers were put in to facilitate his movements considerable economy might be effected in the amount of fuse used.

Where there is machinery running regularly on the surface it is well worth considering the installation of a small electric lighting plant to effect a saving in candles. Usually a convenient counter-shaft can be found, from which a small electric generator can be driven. A generator of two kilowatt output capacity will run about 100 sixteen-candle-power lamps, and the running costs of such lights per 24 hours should not exceed 10s. In very few cases, however, would all lights be on full time, and therefore the daily cost would be considerably less. Even in cases where no counter-shaft is available a small self-contained oil engine and generator installed will often be profitable.

Truck tramming is in most cases done with two boys per truck. This is necessitated by sharp rail curves or bad grading of track. If a track is laid off with easy curves and with a grade in favour of the loaded truck of about a half per cent., one native can easily handle one 10 cubic ft. truck, and with a well-laid track can handle a 16 cubic ft. truck. Incidentally, with the track graded in favour of the load, there is a natural drainage for water to the station.

In a number of small mines it has been found economical to make each drill boy responsible for his own drill steel. The method usually followed is to issue to each boy sufficient drills to enable him to drill the requisite footage per shift. He carries his own steel to the face and returns it to the drill sharpener for dressing, and is responsible for recovering the same steel again from the drill sharpener. As the drills wear out, the short worn end has to be returned before a new one is issued. This system where tried has been found to be satisfactory and economical, few, if any, drills being ever left behind in the mine.

A very large number of picks are purchased annually by small workers, and this could be considerably decreased if instead of discarding picks as points get short new steel is welded on each end. This work can be most profitably done by collecting short picks, so that a number can be done in one job. Drilling hammers, the faces of which have got out of shape, should also be collected, as a blacksmith can face them up and re-temper them.

Steel wire ropes, whether used on winding engines or on windlasses, should be regularly greased, as the life of the rope is thus very considerably increased. In all cases where ropes are being ordered the full working conditions should be specified, such as: Size of winding drum, diameter of headgear pulley; incline or vertical shaft; load to be lifted. This information is necessary in order to allow suppliers to specify the most economical construction of rope.

Pumping water from underground by steam pumps is responsible for a very large consumption of fuel, on account of the heavy condensation of steam in pipes and the large consumption of steam per horse-power with the usual positive motion pump.

In a large number of cases this method of pumping cannot be avoided. In all pumping schemes, particularly from permanent stations, full consideration should be given, however, to the economies which can be effected by the installation of electric or other methods of pumping.

Boilers and steam pipes should in all cases be carefully lagged with non-conducting covering, as the initial outlay will be very quickly recovered by the saving in fuel consumption and general wear and tear of boiler. Scale in boilers causes increased fuel consumption, and heavy scale endangers the life of the boiler.

River waters are, as a rule, free from incrustation solids, but most underground water requires treatment before use as boiler feed. In all cases a sample of the water should be sent to an analyst, who will give a certificate of analysis with notes as to correct treatment. The quantity required for an analysis is about a Winchester quart bottleful. The cost of analysis is small, and the large majority of waters can be easily and cheaply treated, and the results achieved by such treatment fully justify the small expenditure involved.

Unless absolutely unavoidable, cold feed water should not be introduced into boilers. The exhaust steam from engine, pumps, etc., should be utilised for heating the feed water.

Economisers for this purpose can be purchased, but in many cases an apparatus can be constructed on the mine. An advantage in heating the feed water to about the temperature of exhaust steam is that magnesia or carbonate of lime in the water is thrown down before the water enters the boiler. If exhaust steam is introduced directly into the feed water tank, precaution should be taken to eliminate oil before the water enters the boiler.

Ash pits under fire grates of boilers should be made deep, and in no case should accumulations of hot ashes be allowed to remain in them. A very large number of new fire bars are annually used, and the large majority of these are required because the old ones get bent and destroyed by hot ashes in ash pits.

It is more economical to run two boilers, each with an easy load, than to force one boiler, overloaded, to do the same work.

It is very essential in a battery that guides be kept well fitted to the stems. A large amount of play results in broken stems and other parts, cracked mortar boxes and very uneven wear of dies, necessitating a large percentage of metal being discarded.

Amalgamating plates should be regularly dressed to keep the surface in a good condition for catching gold. Great care should, however, be exercised to make sure that too much mercury is not used. The tendency in many cases is to have the plates too wet with mercury, and the result is a loss of both mercury and gold.

Packings, either steam or water, should be stored where dust or grit cannot get at them and in a cool damp place, as dirty packing will cause scoring of rods, making it impossible for the glands to be kept tight. When taking packing underground to pumps it is advisable to have it cut to the correct lengths on surface and carried underground in a closed canvas bag.

Surplus oil should, wherever possible, be caught up and filtered for re-use.

In steam sinking pumps a cup lubricator is generally put on top of cylinder, and the pump boy as a rule fills the lubricator from a bottle at such intervals as he considers necessary. In the large majority of cases the lubricator valve is then

opened full and all the oil in the lubricator is blown through exhaust pipe almost at once. This method is not only very wasteful in oil but also prevents the cylinder and valve from getting the regular lubrication that is necessary, and consequently the life of the pump is shortened.

A better method is to fix a sight feed lubricator on steam pipe either at top of shaft or at nearest station above pump, and regulate the oil feed from there.

At such places the lubricator is easy of access and is not so liable to breakage as if fixed on the pump.

In many cases too much cyanide is used in cyanide plants, the solution being regularly over-strength. As the test for strength is so simple, there should be no excuse for this.

The same remarks apply to lime, which is frequently dumped into a plant casually instead of being regularly fed in correct quantities. Excess lime, particularly lime containing magnesia, may cause complications and extra expenditure in connection with extraction and clean-up.

Slags, old crucibles and other valuable bye-products should not be put through the battery, but should be accumulated and sent to a works where they can be profitably treated. When put through a battery, in very many cases little if any recovery of the gold contents is made. The quantity treated at a time is generally small, and because no gold is noticed in the tailing of mill it is often thought that it is being recovered. It should be remembered, however, that with a small quantity going through the chances are very much against a tailing sample being taken at the exact time when the tailing from the bye-product being treated reaches the discharge outlet of plant.

In a large number of cases no regular samples are taken for fire assay, reliance being placed on panning. This answers very well in some cases, but not in all. When there is any doubt at all as to the percentage of recovery and assay value of heads and tail, samples should be taken for fire assay. If it is desired to avoid the expenditure for daily fire assays, samples can be taken, spread over, say, weekly periods.

When retorting amalgam particular care should be taken that there is no loss of mercury. In many instances the cover of retort is not luted tight, while in others the pipe in cover of retort allows leakage of mercury vapour along the thread.

If in all cases the amalgam is weighed before retorting and the sponge gold and condensed mercury weighed afterwards any loss can at once be located.

When there is the slightest doubt as to efficiency in methods of working a few pounds expended in getting competent mining, metallurgical or mechanical advice is thoroughly justified and will in most cases result in considerable financial gain to the owners.

---

The Commitee wishes to emphasize the necessity there would seem to be for the better looking-after of British interests in the markets of the world.

It has been abundantly proved that prior to the war foreign commercial agents were far more active than our own and were rapidly ousting us from many fields of profitable development. If in the past we in South Africa have been lacking in progress and inert and lethargic in our methods, let us now make up for such faults by urging on our respective Governments the pressing necessity for a more scientific education for the rising generation and by sustained activity on our own part in seeking openings for our products through the development of the great assets we know we possess, so that we may build up new industries in addition to expanding the few we have so far managed to establish. Let us put our many resources to the best possible use, and show that there is abundant scope in South Africa for enterprise and capital. It is up to us to introduce new and better methods, utilising as far as possible the vast quantities of raw material and bye-products the country possesses and generally to put our house in order, so as to let it be seen that we can do more than merely provide for ourselves, and by the time capital becomes freely available once more prove that Rhodesia as well as the Union is of the highest value to the Empire.

We must not, however, begin by over-reaching ourselves through forgetting our present limited market, and try to run before we can walk. Our white population is yet small (under 1½ millions in the Union and not more than 30,000 in Rhodesia), and it is undoubtedly largely due to this that South Africa possesses so few industries. Markets are lacking in the country, and it is therefore a pressing duty for the different Governments to endeavour to enlarge these by securing all the white settlers they can and at the same time providing fuller facilities for the development of the native, for as he becomes more enlightened his requirements undoubtedly tend to increase. Even now his demands are becoming larger every year, and it is not to our credit that we have so far failed to realise that he is one of the greatest sources of wealth the country possesses. We have barely taken the trouble to provide for his needs, let alone encourage his taste for what would be to him luxuries; in fact his custom is largely neglected, when it should be sought after. Improve the education of the native, settle him on areas under some system such as that provided for under the "Glen Grey" Act, and his needs are then shown to rapidly increase. Encourage these, and he will soon be adding to them. If we continue to ignore him and fail to cater for him, we are likely to be the chief sufferers.

Meanwhile, let us be careful that we only create such industries as are likely to remain remunerative after the war; for once peace is established competition from outside is inevitable, and our small white population cannot possibly stand high protective charges for the bolstering up of any industry which finds itself loaded with articles its markets cannot or will not for some reason absorb.

In concluding, the Committee will be glad to have suggestions as to any industry which might be successful in Rhodesia, in regard to which it might be able to advise, and it willingly places its services in this connection at the disposal of any inquirer.

J. G. McDONALD,

Chairman.